SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXVII.—No. 23.
ESTABLISHED 1845.

NEW YORK, DECEMBER 4, 1897.

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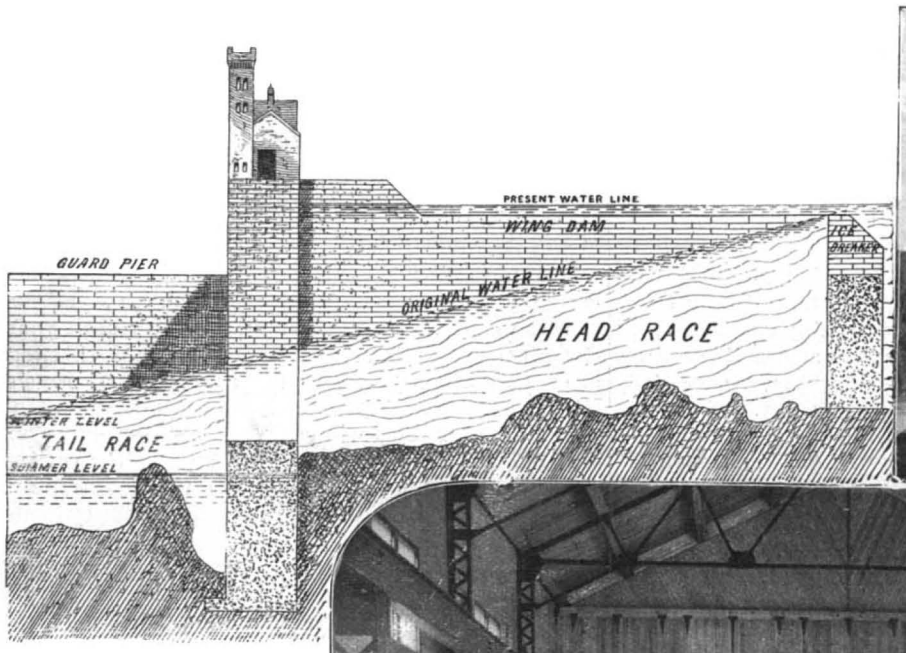
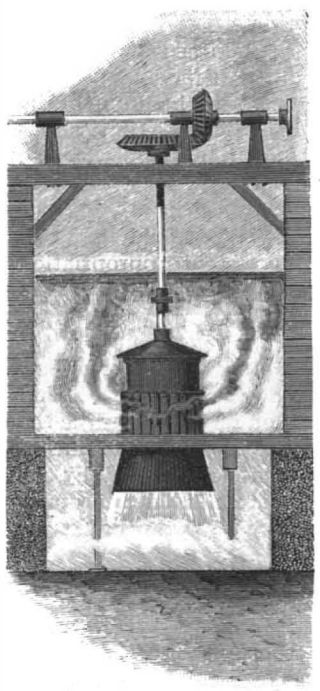
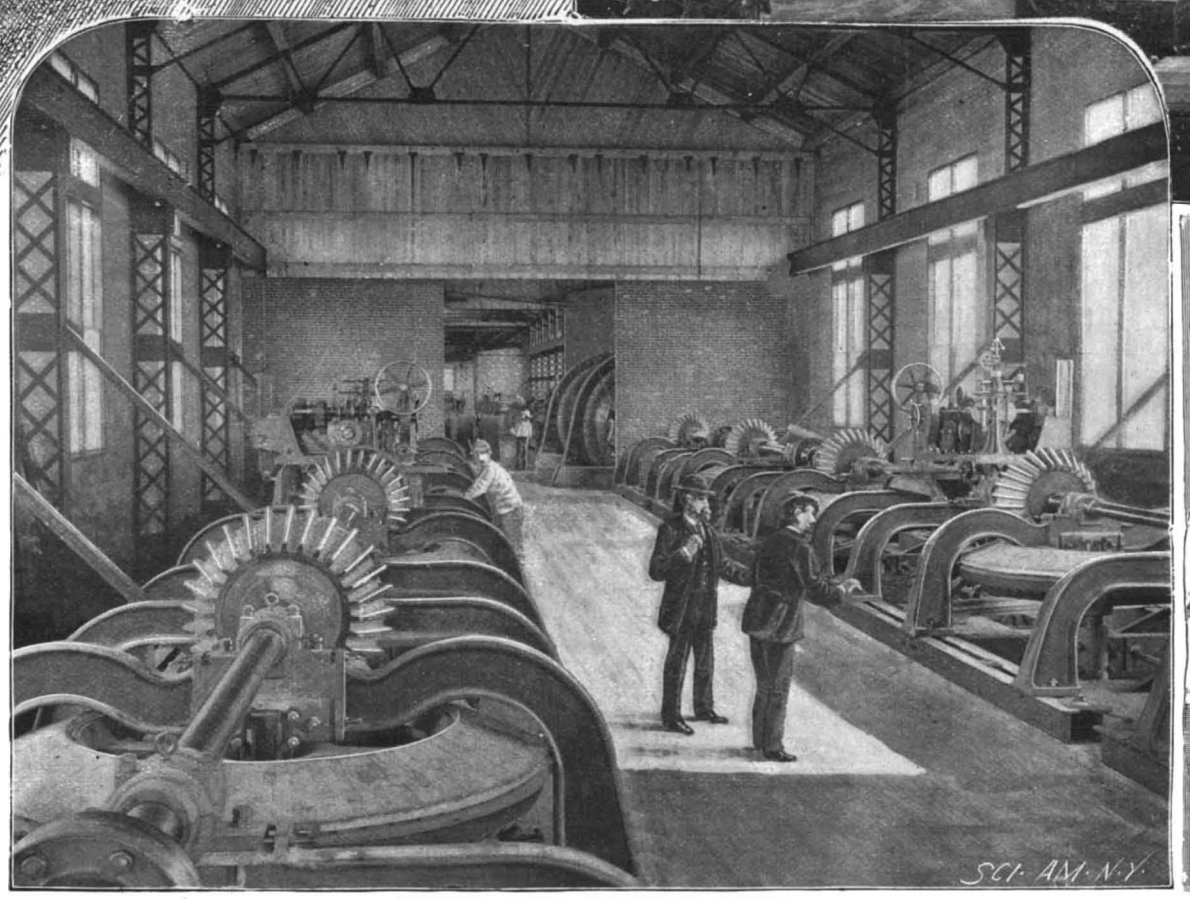
WEEKLY.



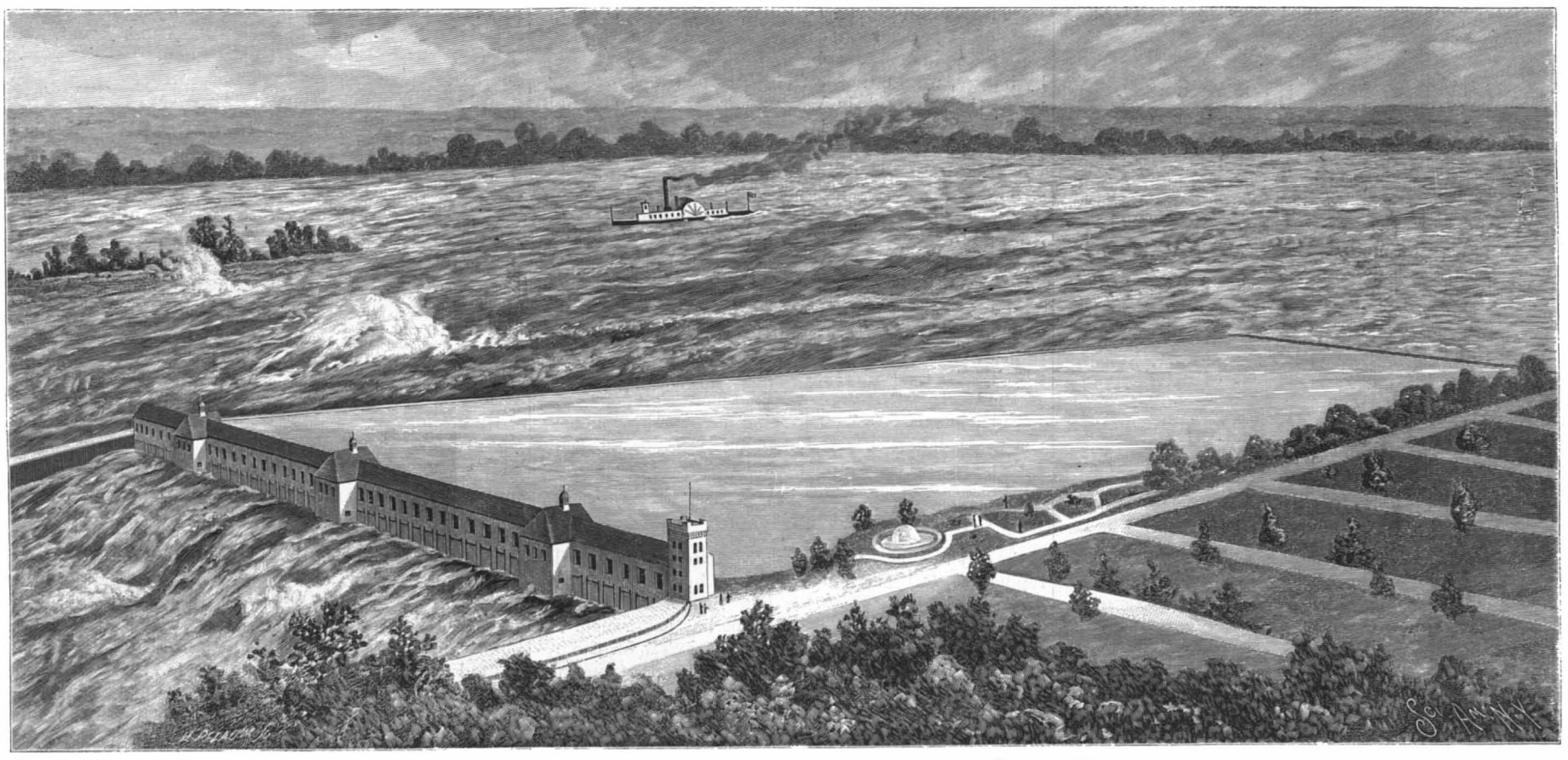


Condensed Profile of the Site.
One of the 300 H. P. Turbines.



INTERIOR VIEW OF POWER HOUSE.

The Power House.
Plan Showing the Site.



BIRD'S EYE VIEW SHOWING LACHINE RAPIDS AND POWER PLANT.

THE LACHINE RAPIDS LIGHT AND POWER PLANT.—[See page 357.]

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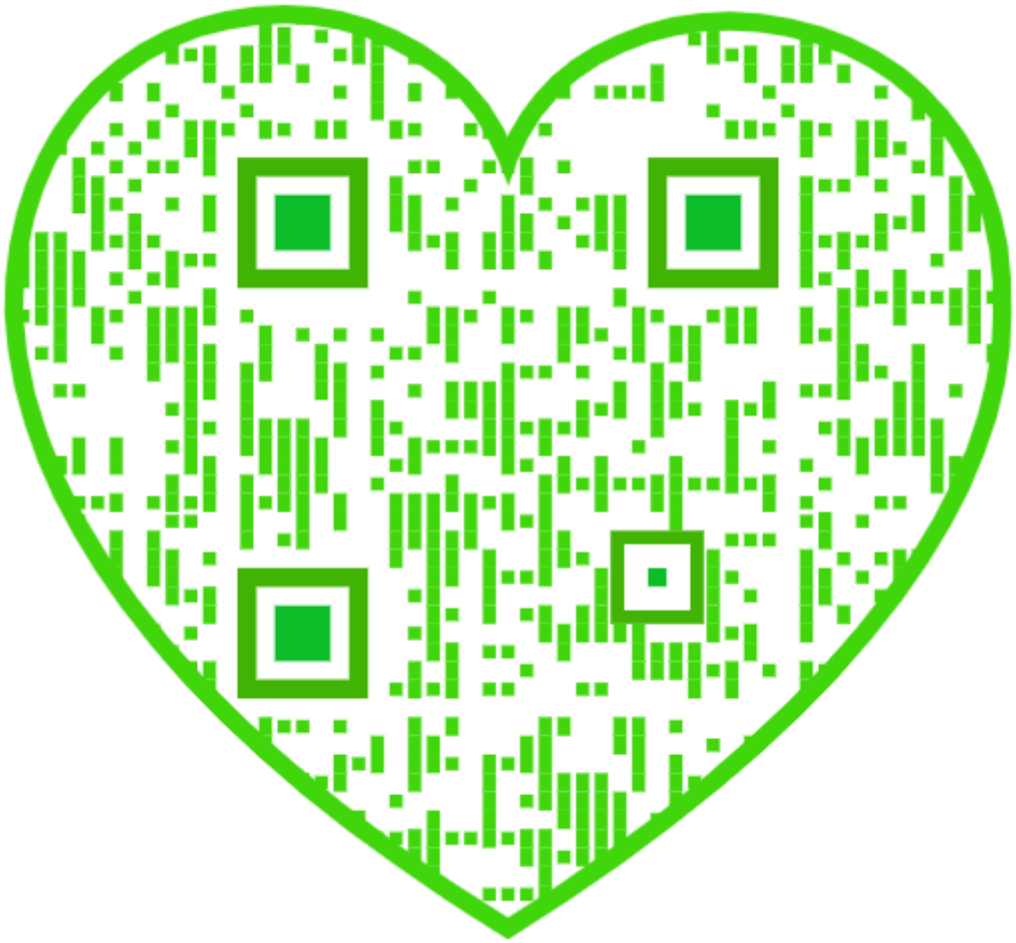

Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS FOR THE SCIENTIFIC AMERICAN.

(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.....**$3.00**
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(Established 1876)

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MUNN & CO., Publishers, 361 Broadway, New York.

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NEW YORK, SATURDAY, DECEMBER 4, 1897.

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Price 10 cents. For sale by all newsdealers.

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THE PROPOSED SHIP CANAL FROM THE LAKES TO THE SEA.

It will be remembered that, under the River and Harbor Act of 1896, provision was made for a survey and estimates for a ship canal from the Great Lakes to the Hudson River at the point where it becomes navigable. The work was intrusted to Major Thomas W. Symons, Corps of Engineers, U. S. A., and his very able and exhaustive report has recently been made public. The subject is handled in an impartial and scientific manner, and in this respect is in refreshing contrast to much of the extravagant and misleading literature that has appeared on this subject.

Major Symons is of the opinion that a canal capable of transferring full sized ocean ships from the sea to the lakes and vice versa is not called for either by commercial or military considerations. Its cost would be prohibitive; not even on the most sanguine estimate would the receipts cover the interest on the outlay and the maintenance expenses; the deep sea ships, even if the canal were built, would not make much use of it, and the freight would be carried in a special type of barge which could just as well be accommodated in an enlarged and improved Erie Canal.

The report states at the outset that, to justify construction, the benefits to be derived from such a canal should be clearly shown to be suitably commensurate with its cost and the cost of maintenance and necessary improvements. Present and prospective conditions limit the depth of a ship canal to 20 feet. The canal should be entirely within United States territory, should terminate at a first class seaport and commercial and industrial center, so that home as well as export trade may reap the benefit. A ship canal by the St. Lawrence route to Montreal, or by the St. Lawrence-Champlain route to New York, does not, in the opinion of Major Symons, fulfill these conditions, and should not be considered by the United States.

The best route for a ship canal is by the Niagara River, Lake Ontario, Oswego, Oneida Lake and the Mohawk and Hudson Rivers. As to the advisability of bringing the deep sea vessels through to the lakes, it is stated that for the best economical results a special type of vessel is needed for the lakes, the canal and the ocean, and neither can replace the other without loss of efficiency. For economical transportation through a canal from the Great Lakes to the sea, special vessels differing from both the ocean and lake vessels are required. Two serviceable canals already exist between the Great Lakes and the Hudson River: the Erie Canal from Lake Erie and the Oswego-Erie Canal from Lake Ontario. These canals are being improved by the State of New York to such an extent that the capacity of the boats will be increased 70 per cent, and it will be possible to carry freight for about 60 per cent of the present cost.

It is estimated that the possible tributary tonnage of a ship canal would be 24,000,000 a year, of which 18,000,000 tons would be carried eastward and 6,000,000 tons westward. A ship canal to accommodate the present largest vessels on the lakes would cost $200,000,000, and the cost of operation and maintenance would be about $2,000,000 per year. Now the Erie Canal, after the present improvements have been carried out, will provide commercial advantages which to all intents and purposes will be equal to those which would be conferred by a ship canal. Moreover, if the Erie Canal were further improved by enlarging it so that it could accommodate 1500 ton barges, and the Mohawk River were to be canalized, such an improved canal, navigated by barges, would enable freight to be transported between the East and the West at a lower rate than could a ship canal navigated by the large lake or ocean steamers. Such an enlargement of the existing canal would cost only about one-fourth as much as the construction of a ship canal; and indeed, even if the ship canal were built, the business, for economic reasons, would be done, not in ocean bottoms, but in barges and boats that could just as well be accommodated in an enlarged and improved Erie Canal.

The proposed ship canal would have no military value, and, in view of the foregoing facts, its construction, in the opinion of Major Symons, is not a project worthy of being undertaken by the general government, as the benefits therefrom would not be commensurate with the cost. On the other hand, the enlargement of the Erie Canal is recommended as being likely to bring returns of a commercial kind fully commensurate with the cost of the work.

THE ANNUAL WAR OFFICE REPORT.

To any one who is accustomed to read the annual reports of Cabinet officers, it will be apparent that Secretary Alger has made a new departure in the annual departmental report which he has just issued. Instead of including only an original review of the reports of commanding generals and the heads of bureaus, his report consists of letters from these parties giving a synopsis of their reports and recommendations, supplemented with comments of his own.

It is estimated that $96,258,445 is necessary to carry out the recommendations of the War Department. Of this sum $48,728,160 is asked for carrying out river and harbor improvements, and this is the largest item contained in the estimates. The Secretary considers that, in view of the fact that the demands upon the Treasury just now are exceptionally large, the suggested appropriation for river and harbor improvement is excessive, and that the grant should be largely reduced below the estimates. In this connection special attention is invited to the fact that the continuous contracts for which the War Office is at present responsible will require an expenditure of over $17,000,000 during the fiscal year ending June 30, 1899, and of amounts in the following four years decreasing to $345,000 during the fiscal year ending June 30, 1903.

Regarding the sea coast defenses and the much needed increase in the army, the Secretary has little to say, and he relies upon the reports of the major-general of the army, the chief of ordnance, and the chief of engineers to make the necessary impression. According to the estimate of the latter official, the amount required for sea coast defenses is $13,378,571—a larger sum than was ever before asked for since the present system of fortifications was begun, the appropriation for the current year being $9,517,141, and for the last fiscal year, $6,345,158.

Secretary Alger is of the opinion that it will be wise economy to push forward the work of sea coast fortifications to the fullest extent, for the reason that, though the work is expensive while it lasts, this item of expense will cease altogether as soon as the present scheme has been completed. "Sea coast defenses," the Secretary goes on to say, "are being rapidly constructed, and they should be completed at the earliest possible date. I cannot emphasize this too strongly, and therefore urge that the full amount of the estimate be appropriated."

The urgent plea of Gen. Miles for the formation of two additional regiments of artillery is strongly indorsed. The general states that we are erecting great sea coast batteries without providing the necessary skilled men to man them.

These costly works should, as soon as completed, be manned by a sufficient force to care for and preserve them, and to become familiar with the handling of the guns, the manipulation of which requires that experienced artillerymen should be on hand at all times to operate them. "A battery costing from $100,000 to $500,000 ought not to be manned by a corporal's guard." The increase called for by Gen. Miles would require a number of new barracks. The present appropriation for these is $420,000 and the estimate submitted by the quartermaster-general is for $2,000,000, an increase of $1,580,000. The increase is a large one; but it is perhaps the most logical and absolutely necessary appropriation recommended by the Secretary; for to spend millions on fortifications and then refuse to provide the men to man them would be the very height of inconsistency and folly. Another item necessitated by our new venture in guns and forts is a needed appropriation of $2,500,000 for army transportation necessary to move heavy ordnance, guns, gun carriages, etc.

Of special interest just now is the reference in the report to the creation of the military reservation of Fort St. Michael, at the mouth of the Yukon River. It is suggested that the creation of further military reservations would be the best means of preserving order in the Territory. It is requested that a boat be provided for transportation and patrol on the Yukon. The Secretary is of the opinion that 100,000 people may be gathered in the Yukon district during the coming year, and he urgently suggests that some adequate measures be adopted to send a military force to that Territory to guard persons and property.

Secretary Alger says of the proposed deep water canal to the Great Lakes that "it marks the beginning of a new era." He quotes the statement of the chief of engineers that the commerce passing through the St. Mary's Falls Canal to and from Lake Superior alone, during the navigable season of 1896, included 16,239,061 tons of freight, valued at $195,146,842, and through the Detroit River, coming from Lakes Superior, Michigan and Huron, about 27,900,000 tons, valued approximately at $300,000,000.

NEW PATENT OFFICE RULES.

In order to harmonize the Patent Office practice with the new patent laws, which go into effect January 1, it has been necessary to make some substantial changes in certain of the rules. These new rules will also be enforced on January 1. They are too long to print in full, but a few of the following changes may be noted:

The new rules specify that no invention is patentable that has been described in any printed publication two or more years before the filing of the application. Heretofore, if a foreign patent has been taken out before an American patent, the term of the latter was limited to the expiration of the foreign patent, which often shortened greatly the term of the United States patent. Under the new rules, no such limitation will be brought about.

Rule 24 specifies that a patent may be obtained for any new invention or discovery which "has not been patented or described in any printed publication in

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this or any foreign country before the invention or discovery thereof or more than two years prior to the application, and not in public use or on sale in the United States more than two years prior to the application."

Rule 29.—The receipt of letters patent from a foreign government will not prevent the inventor from obtaining a patent in the United States unless the application on which the foreign patent was granted was filed more than seven months prior to the filing of the application in this country, in which case no patent shall be granted in this country.

Rule 31 (last paragraph).—"The application must be completed and prepared for examination within one year after the filing of the petition."

Sections 39 and 46.—Rule 2 governs the preparation of the forms of the petition, oath, etc.

Rule 63 states the order in which applications in the Patent Office shall be examined.

Rule 75 brings out the fact that an application may be rejected provided a patent or printed description of the invention has been published more than two years prior to the date upon which the application was filed in this country.

Rule 77 specifies that neglect to prosecute an application within a period of one year will be held as an abandonment of the same.

Rule 98, Section 9.—"Interference will not be declared between an original application filed subsequently to December 1, 1897, and a patent issued more than two years prior to the filing of such application, or an application for a reissue of said patent."

New Rules 166, 168, 171 and 198 touch upon technical rules of practice which need not be mentioned in these columns. The attention of foreign inventors should be particularly called to the new law, as the operation of this law is so much less liberal to foreigners than the present practice that it will be necessary for them to take precautions lest the time within which the United States application must be filed should lapse and the chance of procuring a United States patent thereby be lost.

A GREAT FIRE IN LONDON.

The greatest fire which has visited London for more than two centuries started at 12:55 o'clock on the afternoon of November 19, in the heart of the City, within a short distance of the place where the great fire of 1666 had its origin. It raged for five hours, destroying one hundred and fifty warehouses and a few dwelling houses, involving a loss which is variously estimated from five to twenty million dollars. An area of about seven acres, including about eight streets, was swept over by the flames. The cause of the fire is supposed to have been an explosion of gas. Practically the entire fire-fighting force of London was summoned to the scene, and the streets were soon blocked with goods which were being removed from the warehouses. The historical church of St. Giles, which was the scene of the burial of Milton and of the marriage of Cromwell, was saved. The fire was under control at nine o'clock in the evening. The fire apparatus was handicapped by wagons full of goods which blockaded the streets.

The disaster is likely to raise a spirited discussion as to the methods of conducting the London fire department.

It is very probable that the accounts of the fire which have been cabled are erroneous as regards the length of time which elapsed before the first engine reached the scene of the conflagration, but there is no doubt that the London fire alarm system is totally inadequate. We understand that it has only about one-tenth as much telegraph service as New York for communicating fire alarms.

The fundamental difference between the fire departments of London and New York is briefly as follows: The theory of the London firemen is that, when an alarm is sounded, one fire engine company will be sufficient to extinguish it; so, when an alarm is given at a fire box, the commander of the station rings a bell which summons the firemen throughout the house, and the driver, whose official title is "coachman," takes the horses from the stable in the rear and hitches them to the engine. This engine then proceeds to the fire. Arriving at the scene of the conflagration, if the officer finds that the fire is a serious one, he sends the "coachman" or one of the firemen back to the fire house to telephone to the other stations for reinforcements. As may readily be judged, this results in serious delay, in which valuable time is lost, and time is everything at the beginning of a fire. As each fire engine house has to be telephoned to separately, some little time is likely to elapse before a proper force is mobilized at the scene of the fire. In New York the theory of fire fighting is entirely different. Here the idea is that every alarm of fire is likely to be serious, and in a few seconds after the alarm has been sounded one of the engines summoned is sure to be on the scene of the fire. After the alarm has been given, the operator at the fire headquarters at once sends out the number of the box to thirty engine houses, and the first tap on the key would result in sending 120 horses from their stalls. By the time that the number of the box had been given, the thirty companies would be ready, and three engines, two hook and ladder companies, the insurance patrol and two battalion chiefs would be on their way. The officer in charge of the first company to arrive would, if he judged that the fire appeared to be serious, go to the nearest box and send in another alarm and have eleven more companies at the fire. With a system like that which we have outlined there is little wonder that, while there are more fires in New York than in London, the losses by fire are greater in the latter city. The average fire loss in London in a year is $6,000,000, whereas the average loss from fires in the city of New York has been so steadily reduced in late years that it only amounts to about $3,500,000. The average loss by fire in New York was last year about $800, whereas the average loss from fires in London is $1,200. The outfit of the London fire brigade consists of 68 engines of various styles, 100 hand engines and 135 fire escape or truck companies. New York has 66 fire engines, 69 hose carriages, 28 hook and ladder trucks, and 5 water towers, exclusive of the fire boats. Of course, the area and density of population of London is far greater than that of New York City proper. New York also has splendid fire boats constructed with reference to prompt service, while London's five fire boats are floats upon which fire engines are located. They are towed to the scene of the fire by tugs.

Most of the London steam fire engines are small, weighing on the average about 3,200 pounds, against our engines, which weigh about 10,000 pounds. It will be readily seen that this means a large decrease in steam capacity. The hose is also smaller than that which we use, and in London there is not an adequate supply of water. The London fire department uses on an average 20,000,000 gallons of water a year. Last year the city of New York used for its fire service 45,000,000 gallons, about one-third being taken from the rivers. The London fire brigade is also hampered by lack of facilities for transporting the apparatus to the fire. In 1895 London had only 137 horses, and in many emergencies horses had to be hired to transport the apparatus. Of course, this interfered greatly with the celerity with which the apparatus should be brought to the scene of the fire.

London has about 700 firemen, while New York has about 1,300 in actual service, of all grades. London pays its firemen $516 a year, while New York pays $1,000, $1,200 and $1,400 a year, according to the length of service, while the officers receive salaries in proportion. The total expenditure for maintenance and outlay of all kinds for the London fire department in the year ending March 30, 1893, was $750,000. This also includes what was disbursed for pensions. The cost of maintenance of the New York fire department for about the same period was $2,305,645, without the payments which were made for pensions.

The stinted allowance which is given to the London Fire Brigade has always been detrimental to the improvement and strength of their department, but it is likely that the last serious fire will enable the brigade to obtain a fairly adequate appropriation for the work which they have to do. It is to be hoped that the system of sending in the alarms will be changed to that in vogue in America. It is the first law of modern fire fighting to mobilize the largest number of engines in the quickest time in the smallest space, and fire engineers are now arranging hydrants in many cities so that thirty engines can be placed around a single block.

Mr. Charles T. Hill, in the New York Sun, gives an example of the speed with which fire companies are mobilized in New York. An alarm was received at 11:41 A. M. and the third alarm at 11:45 A. M., four minutes later. In that four minutes five horses were hitched and proceeded to the fire. The officer in charge saw the magnitude of the blaze, hastened to a box and sent in a third alarm signal. This was received at fire headquarters and sent from there to all the companies throughout the city. The fire, which was in Platt Street, was in an oil warehouse. It was one of the narrowest streets—comparable to the streets in London—in a building full of oil and combustible materials, surrounded by buildings filled with stock of like nature, forming the ideal combination for a big conflagration; yet, so well was the fire handled, that the "relief signal" was sent over the wires at 1:24 o'clock P. M., notifying the rest of the department that the fire was under control. In less than two hours a threatening fire was found and conquered, and only a fraction of the entire working force of the department was engaged.

THE HEAVENS FOR DECEMBER.

BY WILLIAM R. BROOKS, M.A., F.R.A.S.

THE SUN.

The right ascension of the sun on December 1 is 16 h. 32 m. 43 s. and its declination south 21 deg. 56 m. 16 s. On December 31 the sun's right ascension is 18 h. 45 m. 5 s. and its declination south 23 deg. 2 m. 55 s. On December 21 it reaches its most southern declination, 23 deg. 27 m. 13 s., and on that date, at 8 hours, the sun enters Capricornus and winter begins.

MERCURY.

Mercury is evening star, and is at its greatest heliocentric latitude south on December 8, at 9 hours. On December 20, Mercury will be at its greatest elongation eastward from the sun, 20 deg. 3 m., and this, consequently, will be the best time to look for this shy little planet. Its southern declination is, however, unfavorable. On December 24, at 11 h. 41 m., Mercury will be in quite close conjunction with the moon, when the planet will be 24 minutes of arc south of the moon.

On December 27, at 11 hours, Mercury will be at its ascending node, and three hours later the planet will be apparently stationary.

The right ascension of Mercury on the fifteenth day of the month is 18 h. 58 m. 18 s. and its declination south 24 deg. 53 m. 55 s.

VENUS.

Venus is morning star. It will be in conjunction with Mars on December 8, at 9 hours, when Venus will be 47 minutes of arc north of Mars. On December 12, at 3 hours, Venus will be in conjunction with Saturn, when Venus will be 56 minutes of arc south of Saturn. Venus and the moon will be in conjunction on December 22, at 5 hours, when the planet will be 3 deg. 40 m. north of the moon. On December 30, at 6 hours, Venus will be in conjunction with Mars, when Venus will be 40 minutes of arc north of Mars.

On the first of the month Venus rises at 5 h. 36 m. and crosses the meridian at 10 h. 35 m. A. M.

On the last day of the month Venus rises at 6 h. 48 m. and crosses the meridian at 11 h. 16 m. A. M.

The right ascension of Venus on the fifteenth of the month is 16 h. 35 m. 21 s. and its declination south 21 deg. 22 m. 15 s.

MARS.

Mars is in the morning sky, and having passed conjunction with the sun in November, is slowly emerging from the sun's overpowering radiance. On December 22, at 11 h. 34 m., Mars is in conjunction with the moon, with the planet 2 deg. 26 m. north of the moon. The conjunction of Mars and Venus has just been referred to in the section on Venus. On the first of the month Mars rises at 6 h. 56 m. and crosses the meridian at 11 h. 37 m. A. M. On the last day of the month Mars rises at 6 h. 44 m. and crosses the meridian at 11 h. 14 m. A. M.

The right ascension of Mars on the fifteenth day of the month is 17 h. 2 m. 48 s., declination south 23 deg. 15 m. 5 s.

JUPITER.

Jupiter is morning star, and becoming quite well placed for telescopic observation, coming as it does into quadrature with the sun on December 30, at 2 hours. At that time it will be 90 deg. west of the sun.

Its position will continue to improve as it moves over 90 deg. more of its stupendous pathway, and it comes into opposition with the sun. We shall resume our notes on the phenomena of the satellites of Jupiter next month.

On December 18, at 2 h. 22 m., Jupiter will be in conjunction with the moon, when the planet will be 6 deg. 50 m. north of the moon.

On the first of the month Jupiter rises at 1 h. 46 m. and crosses the meridian at 7 h. 42 m. A. M. On the last day of the month Jupiter rises at 11 h. 47 m. and crosses the meridian at 5 h. 52 m. the following morning.

The right ascension of Jupiter on the fifteenth day of the month is 12 h. 31 m. 17 s. and its declination south 2 deg. 1 m. 8 s.

SATURN.

Saturn is morning star. Its conjunction with Venus, on December 12, has been referred to in the section on Venus. Saturn is in conjunction with the moon on December 21, at 11 h. 27 m., when Saturn will be 5 deg. 47 m. north of the moon.

Saturn rises on the first of the month only a few minutes before the sun, having passed conjunction but a few days before. On the last of the month it rises at 4 h. 56 m. and crosses the meridian at 9 h. 43 m. A. M.

The right ascension of Saturn on the fifteenth day of the month is 16 h. 16 m. 24 s. and its declination south 19 deg. 34 m. 36 s.

URANUS AND NEPTUNE.

Uranus and Neptune are also classed as morning stars at the opening of the month.

The former is just emerging from the sun's rays, but Neptune is in opposition to the sun on December 12, at 3 hours, and changes to evening star. It is well placed, therefore, for telescopic observation.

The right ascension of Neptune on the fifteenth day of the month is 5 h. 21 m. 25 s.; declination north 21 deg. 45 m. 17 s.

ALGOL.

Minima of the variable star Algol will occur as follows in Greenwich mean time:

Day.	Hour.	Minute.
December 2	14	45
8	8	23
14	2	1
19	19	39
25	13	16
31	6	54

Alternate minima only are given. Others can be found by using the period 2 days 20 h. 49 m.

Smith Observatory, Geneva, N. Y., November, 1897.

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A NEW TYPE OF BICYCLE.

A curious type of bicycle was recently exhibited at the Crystal Palace Exhibition, London. We present an illustration of this new departure in wheel making. The Illustrated London News, in speaking of this wheel, describes it as follows: The frame is constructed on the cantilever system. It consists of twenty-one perfect triangles, is made entirely of steel, and will take any sort of wheels, spindles or chains; if necessary, the

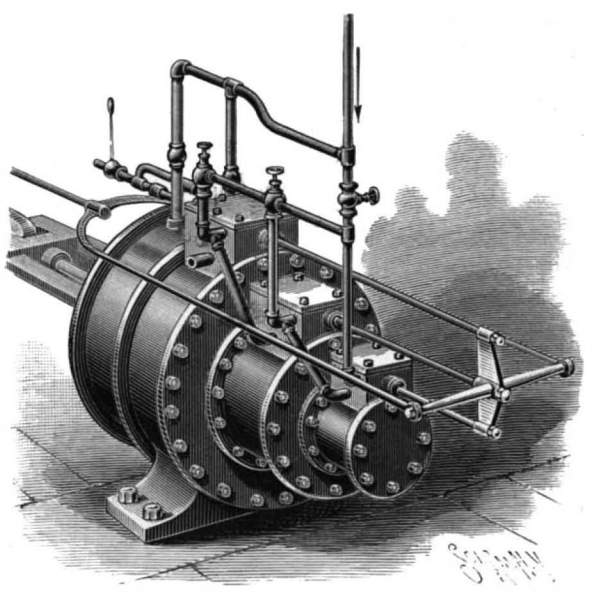
A NEW TYPE OF BICYCLE.

machine can be arranged as a chainless cycle. A feature of this machine is the seat—not a hard saddle, but a "hammock" or "network" seat, which can never become hard or too wide at any point, although it gives the rider more space than any other seat can possibly afford.

Whether the construction lends any special strength or advantages over the present type of wheel remains to be seen.

AN IMPROVED AIR MOTOR.

The motor shown in the accompanying illustration is designed to facilitate the application of compressed air for propelling street cars, it being contemplated that compressed air shall be supplied from stand pipes communicating with pipes laid along the car route. The improvement has been patented by George H. Cooper, of New Westminster, B. C., Canada. The invention provides for obtaining a compound effect, using air at the same pressure it has in the reservoir, which is connected by a valved pipe with the valve-controlled inlet ports of a high pressure cylinder. The exhaust port from this cylinder is connected with similar inlet ports of an intermediate cylinder, and the exhaust port from this cylinder is similarly connected with a third or low pressure cylinder, the slide valves of all the cylinders being operated in unison, and the pistons being all secured to a common piston rod connected to the driving mechanism. On this rod is also secured a piston working in an air compressor cylinder, which is connected by pipes with the supply pipe, the compressor being operated only by the excess of power above that required for the work being done. The compressor thus acts as a brake, particularly on a down grade, as well as serving to partly replenish the supply of compressed air. The motor is designed to effect an economic utilization of the air at the reservoir, dispensing with a reducing valve, affording also an easy control of the speed and a powerful braking action.



COOPER'S AIR MOTOR.

A New Illuminant.

The United States consul at Crefeld says: I have the honor to report an important discovery which, it has been claimed, will in time do away with the present system of illuminating public places, etc., with the electric arc light. The details, briefly, are as follows:

Mr. Ernest Salzenberg, director of the gas works of the city of Crefeld, has invented an improvement in incandescent gas burners which relates to the production of incandescent gas light based upon the discovery that, when the pressure of the gas is considerably increased upon the incandescent body, the said body emits a golden yellow light, very agreeable to the eye, displaying objects in their natural colors.

The gas is supplied to the burner at a pressure of about 3½ atmospheres, the burner to withstand this high pressure being of special construction. A single incandescent jet of the ordinary size can emit a light of much more than 1,000 candle power. The light is of such intensity that a person is enabled to read the finest print at a distance of 100 to 150 feet.

The inventor claims that the cost of his incandescent light of 1,500 candle power is only 4½ cents per hour, while that of the ordinary electric light of 400 candle power is (in Germany) 14 cents per hour.

In the apparatus constructed by Salzenberg a hydraulic pressure of 3·5 atmospheres, and even more, may be forced through the improved Auer burner.

The invention is, however, only applicable where waterworks exist. Mr. Salzenberg has already applied for letters patent in the United States.

Plans for the Zoological Gardens.

Complete plans for the Zoological Gardens in Bronx Park have been prepared by Heins & La Farge, the architects, have been laid before the Park Commissioners and approved. The park was found to be admirably adapted for the purposes of the Zoological Gardens. Here and there a small artificial pond has been made, and walks will be laid out over the whole ground, but the arrangement has been such that if the Zoological Gardens should ever be abandoned for any reason, the removal of the animal houses will convert the whole into a well laid out pleasure park. The animal houses are to be handsome structures designed to fit the landscape features of the park. The elephant house will be a high domed structure near the northern end of the ground. In the reptile house there will be a large center pool for alligators and the like, with a sand beach at one end. Looking across the alligator pool from one side of the house, one will see through three great arches a conservatory of growing palmetto and tropical plants, that will give a naturalness to the scene. The lion house will be provided with newly invented appliances for the care and study of these animals. Underneath the row of cages will run a tramway carrying a cage car that can be lifted up through the floor of the cage by turning a crank, so that an animal may be easily driven into it and carted to a special "studio cage" at another end of the building. Drawings from life may be made of the animals in this large cage. Along the wall of the lion house opposite the cages will be raised steps where spectators may stand and watch the feeding of the lions over the heads of the people on the wide floor space below.

A Word to Mail Subscribers.

At the end of every year a great many subscriptions to the various SCIENTIFIC AMERICAN publications expire.

The bills for 1898 for the SCIENTIFIC AMERICAN, the SCIENTIFIC AMERICAN SUPPLEMENT, and the ARCHITECT'S AND BUILDER'S EDITION of the SCIENTIFIC AMERICAN are now being mailed to those whose subscriptions come to an end with the year. Responding promptly to the invitation to renew saves removing the name from our subscription books, and secures without interruption the reception of the paper by the subscriber.

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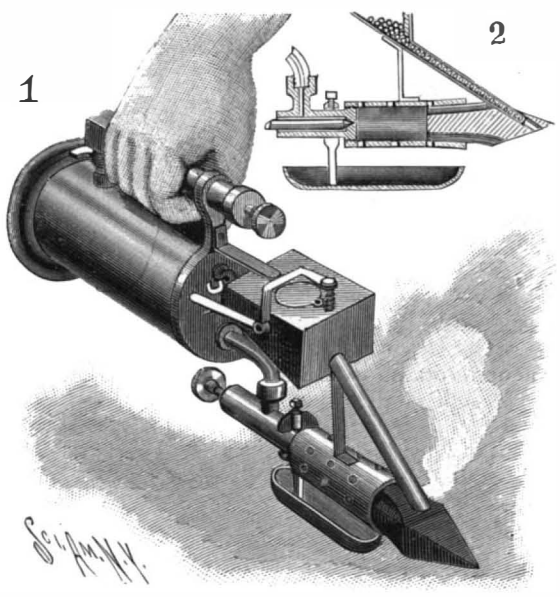
A SELF-HEATING SOLDERING IRON.

The illustration represents an automatically feeding soldering iron, having simple means of heating and keeping it automatically heated, being thus designed to save considerable time as compared with irons that require heating by outside means. The improvement has been patented by John C. Barber, of No. 89 Howard Street, Phillipsburg, N. J. Connected with the iron is a gasoline tank, mounted on which, and also serving as a handle, is an air pump, having a valve-controlled communication with the interior of the tank, from which a pipe leads into a mixing chamber communicating with a burner. The communication between the burner and the mixing chamber is controlled by a needle-pointed valve, on the rear end of the stem of which is a handwheel, and the burner consists of a tube in which are perforations for the admission of air, while in the forward end of the burner is a soldering iron provided with longitudinal channels through which escapes the burning gas, as shown in the sectional view, Fig. 2. Below the burner is a preliminary heating pan, and above it is a receptacle for shotlike pellets of solder, which are fed by a valve-controlled raceway into a diagonal opening through the front part of the soldering iron. The valve is actuated by a lever extending to within reach of the finger of the operator, as shown in Fig. 1. In operation a sufficient amount of gasoline or a similar liquid is supplied to the tank, and air is then pumped into the tank to afford a certain degree of air pressure, after which the burner is first heated by means of gasoline in the preliminary heating pan. The needle-pointed valve is then opened to allow the gasoline to escape into the burner and mingle with air to form a gas, which escapes through the grooves as it burns and thoroughly heats the iron, the solder pellets being automatically fed down to the under side of the iron to be spread over the seam to be soldered. By removing the solder receptacle and the soldering iron, the device may be employed to burn paint from wood or other surfaces.



BARBER'S SOLDERING IRON.

The Consumption of Alcoholic Beverages in France.

A publication issued from the French Ministry of Finance gives some very elaborate statistics as to the quantity of wine, beer, cider and alcohol consumed in the country. From the summary in the London Times we learn that the total quantity is 1,575,000,000 gallons, representing about 1⅛ liters per diem for the whole population of France. Out of the total quantity consumed 967,000,000 gallons are wine, 395,000,000 gallons cider, 202,500,000 gallons beer, and 36,800,000 gallons alcohol.

It is scarcely necessary to say that, while the greater quantity of the wine is consumed in the large towns, the cider is nearly all drunk in the country, especially in Normandy and Brittany, and the official statistics give a table showing what is the consumption of wine in the forty-seven towns with over 30,000 inhabitants. The figures, as might be expected, vary very much, the annual consumption being largest at Boulogne-sur-Seine (59 gallons), Nice (56 gallons), and St. Etienne (54 gallons), while Paris is only thirteenth on the list with 45 gallons. In none of the large towns in the south of France does the consumption fall below 30 gallons, but in seven large towns in the north (Lille, Boulogne-sur-Mer, Dunkirk, Caen, Calais, Roubaix, and Turcoing) it averages only 6 gallons. Another table gives the consumption of alcohol, and here Rouen, Cherbourg, and Le Havre head the list with an annual total of nearly 4 gallons per head of the population, or more than double the quantity consumed in Paris.

AN exhibition of acetylene gas is to be held at Cannstatt, Würtemberg, and will include an exhibition of various generators, lamps, etc. The exhibition promises to be of considerable interest.

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THE LACHINE RAPIDS ELECTRIC LIGHT AND POWER PLANT.

It may be said that the thriving city of Montreal is indebted to the natural barrier of the Lachine Rapids for its existence. The St. Lawrence River can accommodate large ocean-going vessels for the first 600 miles of its length; but here its waters rush through a series of formidable rapids which are quite impassable to deep sea craft. History records how one Jacques Cartier, in his attempted voyage to China, was halted at this spot. The obstacle which stayed the doughty sailor subsequently determined the location of the present splendid city to which reference has been made, and after a lapse of three centuries and a half the vast source of energy presented by the rapids has been impressed into the service of Montreal.

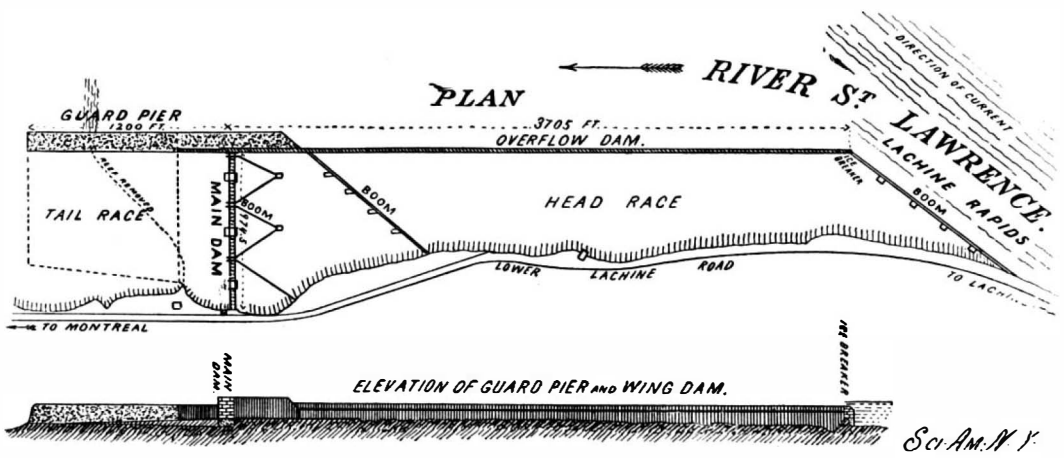
We republish an extremely interesting and historic map, which, together with the smaller map, which has been prepared from later surveys, shows the location of the Lachine Rapids with reference to the surrounding country, and incidentally suggests the origin of the name by which the rapids are known. The original map was prepared by the British, after their occupation of Canada, from the surveys of the French engineers. It is said that the rapids were named La Chine by the explorer La Salle in honor of China, with which his business interests had been identified.

The idea of developing the rapids for water purposes is not by any means a new one. As far back as 1868 a company was formed called the St. Louis Hydraulic Company, in which a number of Montreal's then prominent citizens were interested. But the objects that the two companies had in view were altogether different. That of the original company was to create water powers with factories and mill sites at the rapids, which practically meant bringing mills out of the city and establishing them in the bed or on the banks of the river; whereas the present promoters started out with the intention of transmitting the power to already established factories, wherever situated.

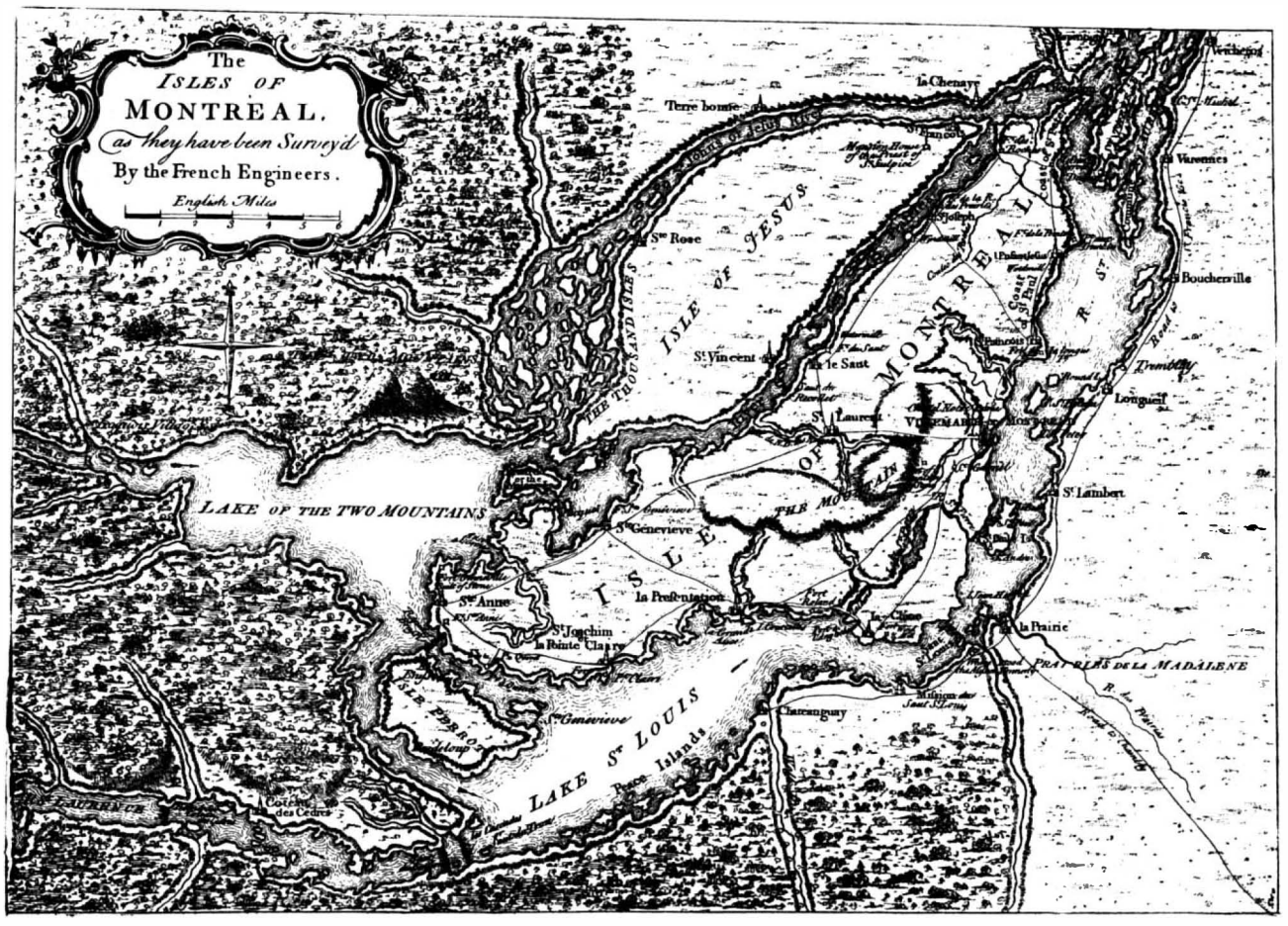
The undertaking was one of considerable difficulty, and one which indirectly as well as directly met with much opposition. To commence with, over 225,000 cubic yards of rock had to be taken out of the reclaimed bed of the river after the temporary cofferdams had been built. One of the most serious obstacles was a troublesome reef of considerable size, which was the cause of many scientific and expert opinions as to the impossibility of carrying out the scheme because of backwater, until the unwatering of the river bed exposed the reason for the phenomena concerning which so much had been said.

It is needless to trace the gradual growth of the work, but before proceeding to a description of the plant as completed, passing reference may be made to a matter which gave rise to considerable discussion among engineers. This was the possibility of the accumulation of frazil and floating ice. In response to many objections to the plan on this score, the engineers of the company, W. McLea Walbank and T. Pringle & Son, issued the following statement: "We do not anticipate any trouble from frazil. By the plan proposed, a reservoir or lake of still water will be formed at the head of the rapids, which will freeze over early in the fall, and as it is a well established theory that frazil will not form on the cover, none will form in this reservoir. There only remains then to deal with the anchor ice and frazil forming in Lake St. Louis and the rapids above us. The current in our proposed head race will be only two feet a second, and as the current in the river will be some 15 or 20 feet a second, no more water can be drawn through our head race than we allow to pass through our wheels; a sort of water dam will be formed at the intake, where the frazil and ice will rise to the surface, and by the swift current in the river will be deflected and carried into the south channel." As far as could be judged last winter, this was exactly what occurred.

The head race is 4,000 feet long and 1,000 feet wide at the main dam on which the power house is built, the depth being 13 feet. It was almost entirely blasted out of solid rock, the blasted rock being used to riprap the wing dam separating the head race from the turbulent waters of the Lachine Rapids. The bottom of the tail race is about 9 feet lower than the head race, and 1,400 feet wide, so that ample provision is made for carrying the water away from the wheels. The main dam and power houses, an illustration of which is given, are of especial interest. There are 43 flumes in the main dam, between which the massive piers of cut stone present a very solid appearance. In each of these flumes, excepting three waste weirs, two 300 horse power turbine wheels are placed. At the mouth of each flume are two vertical sliding gates, and as a protection against floating ice and driftwood three separate booms are provided, one at the entrance to the head race, another about 700 feet from the power house and a third system of booms in zigzag line just above the gates. The wing dam, parallel to the shore and about 1,000 feet distant therefrom, is a mile in length. It is built of 12 by 12 inch timbers, filled with rock, and faced with 3 inch plank.



PLAN AND PROFILE OF THE LACHINE POWER PLANT.



ANCIENT MAP OF THE ENVIRONS OF THE LACHINE RAPIDS.

The equipment includes 750 kilowatt generators and 72 improved cylinder gate wheels, each 54 inches in diameter. Under the average 14 feet head of water obtained, these wheels will develop 300 horse power per wheel. At present only 48 of them are actually in position, although the balance are on the ground, and will be put in shortly. They are put in, in sets of six, that is to say there are at present eight, and later there will be twelve sections, each section consisting of six turbines geared to one jack shaft for driving one large generator, and each section being provided with an electro-mechanical governor for regulating the speed. The power is transmitted from the turbines to the generator shafts by means of mortise bevel gears carefully finished. Each dynamo has revolving fields and stationary armature, and the two parts are so built that one can be moved relatively to the other, in order to give access to all parts for repairs. They have self-oiling and self-aligning bearings.

Each dynamo has a capacity of 750 kilowatts on a non-inductive load and an approximate voltage of 5,000 volts. They have 40 poles and a speed of 175 revolutions per minute; so that the electrical output of the dynamos to the mechanical power on the shaft (including in this one-fourth of the mechanical power required for the exciter when feeding four dynamos) will be about 95 per cent. The dynamos operate in parallel, and when the turbines are adjusted for equal outputs at the same speed, each dynamo carries its own proportion of the total load.

The six exciters are direct current, multipolar, belt-driven dynamos, each of capacity to excite simultaneously the fields of the four alternators when they are running at 10 per cent less than full speed. The armature is iron-clad, with separately formed insulated coils; the brushes, carbon and the machines are mounted on rails with tightening screws. The Canadian General Electric Company, a branch of the American General Electric, guarantees the dynamos and all other work put in by them for a period of one year.

The power house is a fireproof building 1,000 feet in length, composed of three dynamo houses and turbine sheds. A section of the interior is shown in one of the illustrations given. It is of steel framework, the dynamo houses being of pressed brick, while the turbine sheds are steelwork studding, with two thicknesses of inch plank, over which is three-ply felt covered with corrugated iron. The floors of the dynamo house are steel beams and concrete covered with slate one and a half inches thick. An electric traveling crane capable of carrying twenty-five tons runs the whole length of the building, and will be used for handling the heavy parts of the machinery.

Starting from the power house is a pole line which carries the electric power to the outskirts of the city, where it passes underground to the substation. The transmission line is very substantially constructed, the poles being iron lattice, embedded in concrete, with 6 × 6 chamfered cross arms of red pine, carrying six wires of No. 0 B. & S. bare copper. These are supported by double petticoated porcelain insulators, jointed to the steel frame and securely fastened to take up a tension of the line due to one inch of sleet or ice.

The distance from the power house to the Lachine Canal, near the Wellington Bridge, where the wires are attached to a specially designed terminal pole, is about 30,000 feet. From this point the wires are gathered together and formed into a cable covered with paper and lead, and, passing through the manhole and under the Lachine Canal, at a depth of about 33 feet below the coping of the canal, as shown on drawings, it continues thus through the streets of Montreal into the substation. This line is provided at four points with a specially designed Wirts lightning arrester.

There will be in each of the power houses at the rapids a switchboard, taking care of four generators and two exciters, and so constructed that any exciter may be operated in either power house and the whole system work in parallel. It will connect in the tower to the terminal board, from which any machine can

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be switched onto any line. There will also be a substation switchboard in the city which will subdivide the power that is brought in in large units into smaller units, to be distributed as demanded in the city proper, the voltage being continued at the high tension, namely, 4,000 volts, and transformed in manholes in the various sections of the city to 112½ or 225 volts for the secondary distribution. The power house will be protected by a system of electrical pumps and stand pipes and will be heated by electricity.

The work of placing the wires underground in the city was undertaken and successfully carried out by the National Conduit Company, of New York, 500,000 feet of cement-lined iron pipes being laid.

Mention has been made of the substation in the city. This is a handsome pressed brick building situated at the corner of McCord and Seminary Streets. The engineers of the undertaking are T. Pringle & Son and McLea Walbank, of Montreal, to whom great credit is due for the successful carrying out of a difficult engineering work.

The company is offering power and light for manufacturing and private use at a price which will make Montreal a very desirable city for manufacturers, and enable many more families than at present to obtain electric light in their homes. A reduction of 33⅓ per cent on existing prices for electric light has already been announced, while for power purposes the company is offering a rate which is 20 per cent below the present price.

As an instance of the appreciation of the new power which the local manufacturing interests are showing, it may be mentioned that the Dominion Cotton Company, the largest company of the kind in Canada, has decided to substitute electricity for steam power in its mills, and has made a twenty years' contract with the Lachine Hydraulic and Land Company for the supply of electric power from their plant.

OPENING OF THE NEW HOME OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

In a country which is pre-eminently distinguished by the magnitude and skill of its engineering works, the opening of the new house of the American Society of Civil Engineers will have more than a passing interest.

The American Society of Civil Engineers was founded November 5, 1852. In respect of the very strict conditions which govern admission to membership, it is claimed that this society stands first among the kindred societies of the world. The candidate for admission must have an unsullied professional record, and must furnish credentials attested by parties of public repute. He must have been for a stated number of years in charge of some important public work or must have otherwise distinguished himself by his services in promoting the advancement of the science and practice of engineering. The purpose of the society is the advancement of engineering knowledge and practice, and its members consist of civil engineers in all branches of practice, such as municipal, military, hydraulic, naval, mining, marine, and electrical. Meetings are held semi-monthly at which professional papers are presented and discussed. These papers are subsequently published by the Society in volumes termed "Transactions," of which thirty-eight have been issued to date. The Society also publishes a monthly periodical termed "Proceedings." Complete copies of "Proceedings" and "Transactions" are sent to every person connected with the Society; also to many other societies, libraries, and technical publications. The papers presented to the Society, of which over eight hundred have been published to date, have covered every branch of engineering, general and specific. These papers are of value not only to the members but to the public, in that they are frequently drawn upon by the general press to keep the public in touch with the great problems and enterprises of the times.

During its existence the Society has accumulated an extensive engineering library, and the necessity for its expansion was one of the causes leading to the building of the new house. It is a strictly professional library, in which there are now some 22,000 volumes. The present roll of members includes some twenty-one hundred engineers in all grades, and it embraces representatives of the profession in all parts of the world, a large number of foreign engineers being connected with the Society. The strict requirements for admission to full membership and the fact that the roll includes practically every engineer of note in the country render corporate membership in the Society the highest professional indorsement attainable.

For some time after organization the Society meetings were held in the office of the Croton Aqueduct Department in Rotunda Park, New York, which was located in what is now City Hall Park, facing Chambers Street near Center Street. In 1867 it moved to rooms in the Chamber of Commerce building, 63 William Street, and as its membership increased moved successively to enlarged quarters; in 1875 to the southwest corner of Broadway and Twenty-third Street, and in 1877 to the house No. 104 East Twentieth Street. In 1881, the house No. 127 East Twenty-third Street was purchased, to which a large addition was made in 1889, and the work of the Society has since been carried on at that place. The increasing size of the library, and the necessity of providing adequate accommodation for the increasing number of members, have led to the construction of the present very handsome house. The project was first started in the spring of 1895, and the present site, 220 West Fifty-Seventh Street, was purchased and actual work begun in the fall of 1896. The cost of the building is $200,000, the society's assets being about $250,000, and its present gross income over $40,000.

The new building, located on West Fifty-seventh Street, near the Carnegie Music Hall and opposite the Fine Arts building, covers a plot of 50 by 110 feet. It is a choice example of French Renaissance. It is built in Indiana limestone richly carved, and both within and without it does considerable credit to the architect, Mr. C. L. W. Eidlitz. On the first floor are the reception room, coat room, and the offices of the secretary, as well as a large room intended for a convenient meeting place for members for social and business intercourse. On the second floor are the reading room and auditorium, the latter having a seating capacity of over four hundred. On the third floor space is reserved for a museum and model room, and here also

NEW HOME OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS, NEW YORK CITY.

are the offices of the clerical force. The fourth floor is devoted to the stack room, which has a total capacity of over one hundred thousand volumes. The stacks are similar to those used in the new Congressional Library at Washington. An electric book lift runs to the reading room on the second floor. In the basement are janitor's quarters and large storage and publication rooms. The building is steam heated throughout and lighted by electricity, the energy for which is provided by two gas engines of 25 horse power each. As this society is purely a scientific body, the building is in no sense a club house. Its use is exclusively for the advancement of the science of engineering, and it is the first building erected in America to be devoted to the exclusive purpose just named.

The Society formally threw open the doors of the new building on Wednesday, November 24, when the members and invited guests assembled in the auditorium, where addresses were delivered by Benjamin M. Harrod, President of the Society; Gen. William P. Craighill, late Chief of Engineers, United States Army; President J. G. Schurman, of Cornell University; and Joseph H. Choate, of New York City.

Gen. Craighill gave a brief review of the history of the Corps of Army Engineers from the date of its formation in 1802. He stated that Gen. Washington, though a surveyor, was not strictly speaking an engineer, and the revolutionary army was dependent upon the services of foreign military engineers, chiefly French, who as late as 1816 were engaged in designing the defense of the country. West Point military school was established largely with a view to remedying this defect, and since its establishment it has turned out a body of men who, for thorough grasp of their profession, were unsurpassed in any country. Referring to the proposal to establish a code of ethics to govern the engineering profession, Gen. Craighill considers it quite unnecessary, the observance of all the due courtesies and proprieties of the professional man being insured by the simple keeping of the golden rule, "Do unto others as you would they should do unto you."

President J. G. Schurman, of Cornell University, said that the profession of civil engineering was essentially American, inasmuch as it was closely concerned with all that is specially characteristic of American civilization. In the Old World—in London, Paris or Berlin—it is the matchless works of art and architecture that leave a lasting impression. In America, it is the splendid works of engineering that fill the visitor with admiration and leave an abiding impression. Our vast and daring feats of construction, as shown in bridges, buildings, railroads and water works, have given us the stamp of an engineering race. This is now recognized as essentially one of the learned professions. The schools of engineering rank with those devoted to the so-called learned professions, and justly so, for the same degree of culture is required in them as in those devoted to the law and to letters.

Joseph H. Choate paid an eloquent tribute to the engineer's profession, and in comparing it with those of medicine and the law, he dwelt upon the advantage and solid satisfaction to be derived by the engineer from the fact that his work was based upon known facts and the clearly ascertained and unchanging laws of nature, whereas that of the law at least was based largely upon tradition, opinion, and judgment. The profession is enduring as the ages. The lawyer's fame dies with the silencing of his voice in death; the name of the engineer is as lasting as the imperishable works which are the monuments of his skill.

Mr. Choate referred to the city of New York under its new charter and thought that within its 360 square miles were contained more engineering problems—soon to demand solution—than were contained in all America fifty years ago. If the city is to be successfully administered, it was absolutely necessary that all municipal works should be controlled by engineers; at least he would express the hope that they might never be put under the administration of lawyers who were as ignorant of civil engineering as the speaker.

Mr. Choate concluded by stating that in view of the present meeting he had been reading one of the most fascinating works that had ever come into his hands, and he evoked genuine enthusiasm by giving the title as Smile's "Lives of the Engineers."

The Palace Motor Car.

A member of the Automobile Club de France has just had a steam "house car" constructed to his order by M. Jeantaud, the Parisian builder of motor cars. The car is propelled by a steam motor of 30 horse power. It is 25 feet long and is over 8 feet in width and height. The outside is painted a pale green, and the entrance to the interior may be gained either by folding doors at the side or by the door at the rear. Down the side of the car runs a corridor with doors opening into the different rooms. The first room is used during the day as the salon and at night as a sleeping room, a couple of divans being turned down to form a bed. Every spare inch is devoted to cupboards. Another room of the same size is to be used as a dining room, and when not employed for this purpose the partitions at the back and side may be folded up, thus forming a large salon. There is also a lavatory and bath room, and behind this is a kitchen containing a range, a cupboard for the cooking utensils, and under the floor is a safe for the provisions. On the top of the car seats are provided for three or four persons, and here also are carried the supplies of water and food. Enough fuel can be stored away to run the car for three hundred miles. The fore part of the vehicle is supported by the tractor of the Dion type.

A Hint to Manufacturers and Merchants.

The importance of registering trade marks at the Patent Office does not seem to be sufficiently realized by manufacturers and merchants in this country or abroad. Persons adopting a word, phrase or emblem to distinguish their specialty of manufacture, whether it be on dry goods, groceries, food products or preparations of any kind, will derive more benefit by registering them than many seem to realize. Full information as to the necessary procedure to obtain trade mark protection may be had by communicating with this office.

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Correspondence.

Fatal Cases of Rattlesnake Poisoning—Antidotes for the Venom.

To the Editor of the SCIENTIFIC AMERICAN:

In June, 1891, the writer recorded in these columns a death resulting from the bite of the little coral snake of Florida (Elaps fulvius), often regarded even by some scientists as harmless to man. The article attracted wide attention, owing to the fact that it was one of the first authentic cases of the kind ever published.

During nearly fifteen years' residence in Florida, I never heard of but this one death resulting from the bite of a venomous serpent, although three other poisonous snakes are quite common within the limits of that State. These are the great diamond rattlesnake (Crotalus adamanteus), the little ground rattlesnake (Candisona miliaria), and the water moccasin (Ancistrodon piscivorus). It may be added that the copperhead (Ancistrodon contortrix) has been found in the northern part of the State, but its common habitat is farther north.

A few weeks since, however, I received reliable information of two fatal cases of rattlesnake poisoning in Florida. One was the little daughter of James Morgan, a resident of Fort Drum, who received the venom of a rattlesnake and died within two hours afterward. The other was that of a young man, Edwin Hall by name, who was bitten by a large rattlesnake while surveying near Punta Gorda. The reptile buried its fangs into the young man's leg before he was even aware of its presence. The victim was so panicstricken at this sudden attack that he ran at the top of his speed from his companions, thus actually assisting the poison to circulate more rapidly throughout his system. He was finally overtaken, however, when a shoestring was tied tightly around his leg above the wound. None of the usual remedies could be found among the few settlers nearby and the man was taken to his home at Punta Gorda. His leg swelled and he suffered greatly with pain in that member. On reaching home, a physician was immediately summoned, who administered remedies both externally and internally. But the deadly virus had gained the ascendency, and the victim finally died in great agony the same evening—about nine hours after the accident.

Had the deceased been in the habit of carrying a small vial of permanganate of potash about his person when on his trips in the woods, and had he retained the presence of mind to use it immediately after receiving the bite, no serious results would have followed.

Persons who live in sections where venomous serpents are liable to be encountered should always carry this antidote. To use it, the wound should first be enlarged and then saturated with the drug, after having first tied a shoestring, suspender or like ligature around the limb—for the leg or arm is usually the point attacked.

Speaking of antidotes for snake poison, Dr. Thomas R. Fraser, of the University of Edinburgh, Scotland, has recently made public what he calls "an absolute antidote for the bite of the most deadly serpent." Continuing, he says: "I have also found that the substance from which the antidote is secured is strongest and best in the serpent whose bite is the most deadly." Briefly stated, this new antidote is the bile or secretion of the gall bladder. In its crude form, the bile is only administered directly to the wound or by the stomach. But the antidotal constituent of the bile is said to be the most effective when it is separated from the remainder of the substance found in a serpent's gall bladder, and injected beneath the skin. Dr. Fraser says the bile of any serpent is an antidote for the bite of a venomous species. This seems very reasonable, for, as has long been known to scientists, the venom of poisonous snakes has no ill effects when introduced—by accident or otherwise—into either their own circulation or that of the harmless kinds, common belief to the contrary notwithstanding.

Washington, D. C. CHARLES H. COE.

United States Machinery and Tools in Germany.

Consul Crane sends from Hanover, Germany, under date of September 17, 1897, a report which will be published in Commercial Regulations, 1896–97. An extract therefrom of current interest is as follows:

The principal enterprise now on foot in the department of transportation is the extension of the net of electric lines far out of the city, to Hildesheim, fourteen miles away, and the engraftment thereupon of not only a light, but also a heavy, freight traffic. It would not be surprising should wide awake representatives of United States firms interested in such constructions find that there are devices at their command which the Germans would be glad to adopt.

In this connection, it may be remarked that the frequency of railway disasters in this country of late has awakened public attention to a degree that might be suggestive to some of our United States inventors and manufacturers of railway appliances. In an incident of this kind that occurred near here but a few weeks ago, one of unusual severity in its consequences, it was frankly admitted that had not the American air brake operated perfectly, the loss of life must have been much greater. To take advantage of such a hint as this, the parties interested must be on the ground, and for a long time, too, in order to make investigations on their own account and in their own way, as opposed to the manner in which official investigations are conducted.

Miscellaneous Notes and Receipts.

Causes of Spontaneous Combustion of Oils.—In connection with the experiments instituted by R. Kissling, as regards the increase of temperature caused by impregnation of fibrous or porous stuffs with linseed oil, the author states the results of his researches. In accordance with former observations, a maximum of weight by absorption of oxygen in the case of raw and boiled linseed oil only appears after several days, while with oils treated with metallic oxides this is the case already after twenty hours, old linseed oil showing one of 15–16 per cent, young products up to 19 per cent at most. The spontaneous combustion is well exemplified by the following experiment: A piece of wadding which had been used for the filtration of oils, that contained, besides copal, resin and turpentine oil, chiefly linseed oil boiled with metallic oxides, was laid in a place exposed to the wind, so as to prevent a supply of heat from outside. A thermometer stuck into it soon showed 60°, then 138°, inside of 45 minutes it had reached 275°, and suddenly rose above 300° (C.?) On folding the wadding apart, the interior was found to be strongly charred, and in the charred places glimmering was at once perceptible, which passed into ignition upon admission of a draught of air. According to the explanation of the author, an autoxidation was made possible in consequence of the presence of metallic compounds and the previous heating. Owing to the poor conduction of heat, the heat was held together and through decomposition of organic substances carbon was liberated, which took fire through a supply of air. Further experiments demonstrated that ignition is only possible if the separated carbon comes into contact with a sufficient volume of air.—W. Lippert, Zeitschrift für Angewandte Chemie.

A Peculiar Fabric, which may find a use for many purposes, is made in Brussels. It is flexible, transparent and impervious to water. This textile material can be washed off with cold water, like a glass pane, by means of a sponge, and is mainly to be used for portieres, window shades, umbrellas, etc. The patented process for the production of this tissue consists in filling the meshes of a wide-meshed fabric, such as muslin, with chrome gelatine or with a similar material and then rendering the chrome gelatine insoluble by exposure to light. The fabric is then coated on both sides with boiled linseed oil or fat varnish; the treatment with chrome gelatine and linseed oil is repeated several times and the fabric is ornamented by printing.

Polish for Machines.—Mix intimately 10 parts oil of turpentine, 20 parts stearine oil and about 30 parts of the finest blood coal. This mixture is strongly diluted with spirit and spread with a brush on the machine parts to be cleaned. When the alcohol has evaporated, the coating is rubbed with dry blood coal and rouge, crocus or any other suitable polishing medium. The remedy is said to have been found valuable.

Indelible Ink without Silver Nitrate.—Grind 1¾ grammes of aniline black well with 60 drops of strong hydrochloric acid, and 42 to 43 grammes of alcohol. The liquid thus obtained is diluted with a hot solution of 2½ grammes of gum arabic in 170 grammes of water.

Tortoise Shell Imitation for Inlaid Work.—Technically, the process of imitating tortoise shell is quite simple, but to produce charming patterns a certain amount of skill is necessary. A light gelatine solution is poured, while warm, upon glass plates and asphalt lake is dropped on the upper side in such a manner as to imitate the natural design of the tortoise shell. After it is cold, the gelatine is detached from the glass plate and in a few days may be used for inlaid work. If yellow tortoise, i. e., tortoise from the Chelonia caretta (sea turtle), is to be imitated, the ground of the wood to be used for inlaying should be painted yellow; for red tortoise it should be painted with a suitable red, whereby the gelatine skin, being transparent, will receive the correct natural coloring of the tortoise. The natural tortoise shell is prized the highest when beautifully speckled with very dark spots.

Perfumed Glycerine, an Excellent Hair Oil.—Glycerine possesses in a high degree the property of extracting the fragrance from flowers. Besides, it has proved to be excellent for the skin as well as for the hair, so that it puts even the finest olive oil in the shade. If we take a vessel of best glycerine, putting into it lilacs, faded hyacinths, narcissus, lilies of the valley, mignonettes, violets, roses, lime flowers, jasmine flowers, etc., and leave them in it for three weeks, they will have given off their whole fragrance to the glycerine when taken out. In this manner a hair oil is obtained that cannot be surpassed by any Parisian "parfumeur." Since glycerine can be mixed with water in any proportion (in contradistinction to the fat oils), a few drops may be poured into the water used for washing, in order to perfume it delicately.

Science Notes.

The London correspondent of the New York Evening Post telegraphs that at Maidstone vaccination is being used against typhoid under the direction of the pathological laboratory of the State Army School at Netley. Prof. Wright and Surgeon-Major Temple, of Netley, have so improved the method that they are able to obtain the characteristic reaction of blood serum on typhold bacilli, which is taken as a proof that the individual is protected by the injection. Enough vaccine has been sent to Maidstone to inoculate the whole population if necessary. The number of cases of typhoid fever reported is greater than 1,500.

A cable dispatch from London says: A wonderful application of the perfected phonograph has been made by Mme. Anna Lankow, a vocal instructor of New York. She had several talented pupils anxious to secure European experience. Theodore Wangermann, a phonographic expert, supplied the delicate cylinders, and, under his direction, the pupils sang their best into the phonographic horn. Mme. Lankow took the cylinders to Berlin, where the voices were reproduced for the German managers. The experiment was so successful that engagements to sing in Germany in concert and opera were obtained for two of the pupils, based solely upon the phonographic samples.

According to the New York Tribune, the most interesting work now going on at the Weather Bureau is the preparation of an exhibit of this bureau for the Paris exhibition in 1900. Prof. Moore is taking a deep interest in the matter, and, as planned, it will be one of the largest and most complete expositions of this character ever made. A feature of the exhibit will be a daily weather chart of the United States. A code has been adopted by which the conditions of the weather in all parts of the United States will be transmitted by telegraph to Paris. From the material thus obtained maps will be constructed on the order of those now in general use. Prof. Moore, with five or six of his subordinates, will represent the Weather Bureau at the exposition, and nothing is being left undone to make a showing worthy of the United States Bureau, which is acknowledged by scientific authorities to be the finest in the world.

The municipal authorities of Paris are just now engaged in the suppression of an altogether novel form of food adulteration which is assuming phenomenal proportions, says the New York Tribune. Real oysters are expensive in Paris, and so, with the object of suiting slender purses, artificial oysters on the half shell have been invented, which are sold at twenty cents a dozen, and they are so cleverly made and look so nice and fresh that, once lemon juice or vinegar has been added, they cannot be distinguished from the real article, especially when white wine is taken in connection therewith. The only genuine thing about these oysters is the shell, the manufacturers buying second-hand shells at a small cost, and fastening the spurious oyster in place with a tasteless paste. The municipal laboratory has not yet proclaimed the ingredients of which these bogus oysters are composed, but has announced that they are of a harmful character.

Prof. A. E. Dolbear writes to Science as follows: Those who have occasion to have copies of engravings or pictures of any kind made for use with the lantern may be glad to know that such may be printed from the plates used in ordinary printing, if sheets of thin transparent celluloid be taken. Gelatin also may be used. The latter is liable to roll up more or less and needs to be protected by inclosing between glass plates of the ordinary size for lantern slides. Celluloid will not trouble so much in that way, yet it is best to mount such pictures in the same way. Photographic half-tones show very well indeed, the fine meshing not being enough magnified nor dense enough to be noticed upon the screen at the distance of a few feet. Such copies need cost but a few cents apiece, if the electro can be got to print from; and if celluloid be used without the glass cover, perhaps one cent would be the full cost. I inclose a couple of samples that you may judge of the quality of such pictures.

Mr. H. Savage Landor, who left England in March last, commissioned by Mr. Harmsworth, the proprietor of the Daily Mail, to endeavor to enter the sacred city of Lhassa, in Tibet, has not been successful in his undertaking. News has just been received that a few days after crossing the frontier of Tibet, disguised as a Chinese pilgrim, all except two of Mr. Landor's men abandoned him. In spite of this, Mr. Landor continued on his journey, but eventually he lost all his provisions, and by an act of treachery was made a prisoner by the Tibetans. He was sentenced to be beheaded, but at the last moment the Grand Lama stopped the executioner, and commuted the sentence of decapitation to the torture of the stretching log—a kind of rack upon which Mr. Landor was chained for eight days—after which he was released. Mr. Landor has now returned to India, suffering from the effects of the torture to which he was subjected, and which he half anticipated before he set out upon his hazardous journey.

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Loss in Stoppages of Electric Cars.

Prof. H. S. Herring, in The American Electrician, says: From a large number of tests I found that the difference between making a stop and start at a station and running past it varies from 75 watt hours to 100 watt hours according to the grade and load, the average for ordinary conditions with a partially loaded 7½ ton car being 85 watt hours per stop. These tests were made by running the car over a road on which definite stopping places were designated, and a different number of stops made on successive trips, each trip being repeated for the same conditions until the readings agreed. The car was loaded with sand bags and weighed on car scales. These values, being obtained from about 100 such tests, are fair average results, but cannot be depended upon for any particular case, as conditions may cause a very large variation. But as an illustration of how these small values aggregate, the following figures may be interesting: Assuming the cost of electrical energy at 1 cent per kilowatt hour, one stop would cost 0·085 cent, nearly one-tenth of a cent. At this rate, the cost of making one extra or unnecessary stop on each trip for fifteen trips daily would amount to 1·28 cents per car per day, and $4.67 per car per year; for fifteen cars, $70 per year; and for 100 cars, $467 per year, merely for one extra stop per trip. This does not include the cost of brake shoes and wear and tear nor the capital invested in the increased size of the power house. Taking an actual instance of an engine house located where two lines of cars pass the door, thirty cars making fifteen round trips a day and each car passing the engine house twice on each round trip, it was found that on this same basis it costs the railway company for electrical energy alone seventy-six cents per day or $278 per year to stop its cars at this one place. Even should the assumption of one cent per kilowatt hour prove too high, yet the results are important.

In reference to the effect of careful handling of the controller, I would say that the difference between the kilowatt hours per car mile required by two motormen is very marked. A number of experiments were made in order to obtain some data. A good average motorman was selected and instructed to run his car in the usual manner. The other motorman was instructed to run the car in the most careful manner, allowing it to "drift" as much as possible and to use the brakes as little as possible. The same car was used in both instances, and was run on regular schedule time, making the same number of stops. The careful motorman used only 80 per cent of the kilowatt hours used by the "regular," although the latter was not careless, but rather above the average motorman. The difference of 20 per cent in the kilowatt hours used by these two motormen represents average conditions and not exceptional ones, but for the sake of avoiding possible exaggeration and allowing that such expert motormen cannot be readily obtained, it would be perfectly safe to halve this figure and take 10 per cent as the amount of energy that can readily be saved by more careful handling of the controller, while on most roads the larger value, or at least 15 per cent, could be saved without doubt. A few calculations based on a saving of 10 per cent may be of interest, being the gain that would result by using less power on the line. Taking the average performance in city running on a ten-mile, fifteen-car, fifteen-trip road as 1,300 watt hours per car mile, a 10 per cent saving amounts to 1·3 cents per trip, 19·5 cents per car per day, $71.20 per car per year, and $1,067 per year for the entire road, or for a company operating 100 cars this amounts to over $7,000 per year.

PRACTICE WITH THE HORIZONTAL LIFE LINE.

A SCHOOL FIRE DRILL.

It is the policy of many schools not to let pass any opportunity which school life may offer to keep the students constantly employed in those forms of right activity which may interest them to make the most of themselves; hence the military drill which is found in so many schools.

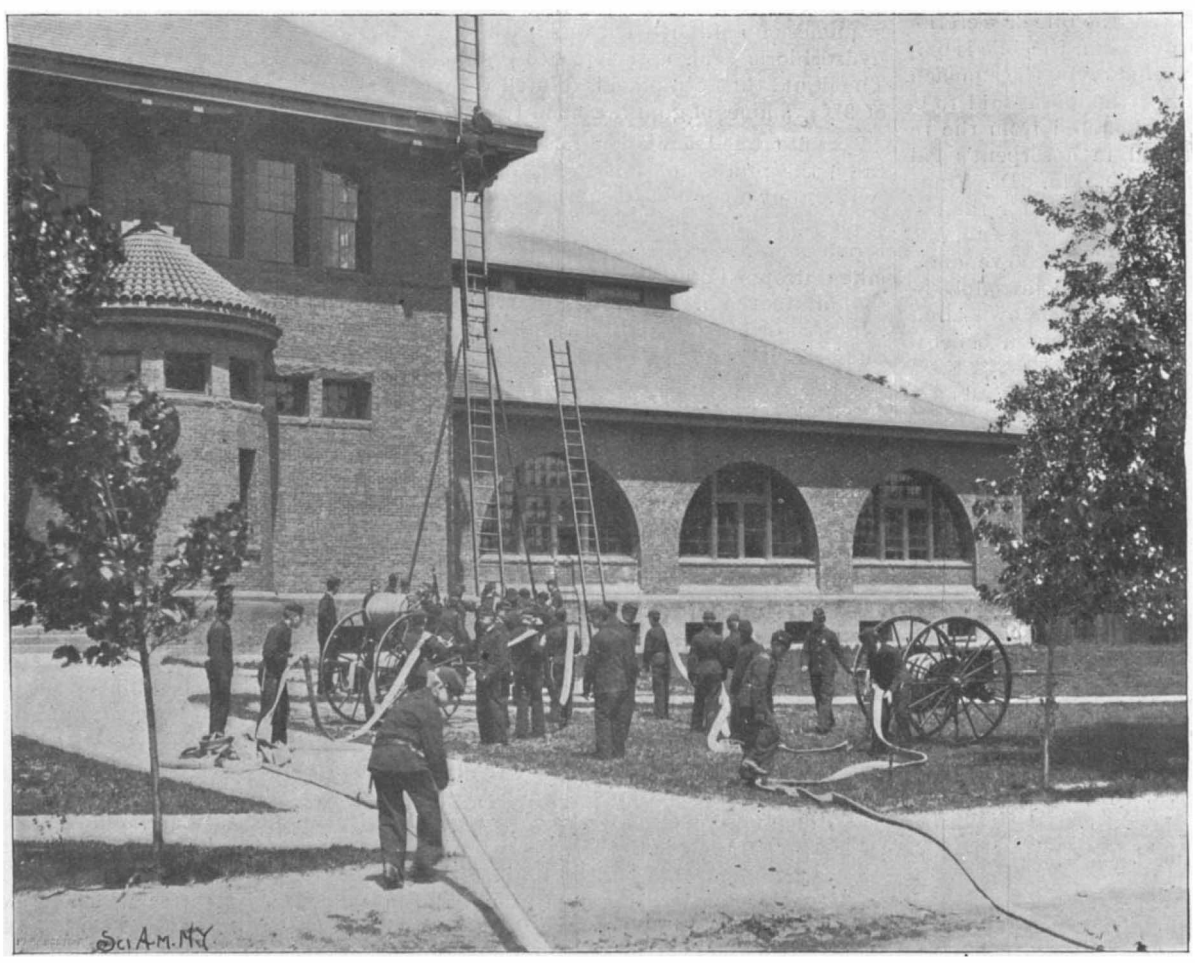
We illustrate and describe a system which combines both military exercise and a useful training of the faculties. It is the fire drill as practiced at the Cambridge Manual Training School for Boys, Cambridge, Mass. There is little doubt that a drill of this kind possesses more usefulness as an educational force than even military drills. As the chairman of the Boston Board of Fire Commissioners recently said regarding the school: "Instead of theoretical soldiers, they are making practical firemen. The modern methods of fire fighting are sufficiently scientific and exacting to produce as large results, whether physical or disciplinary, as any sought by military drill."

As mentioned in the SCIENTIFIC AMERICAN for September 18, 1897, this school furnishes the nearest approach to a school of fire extinguishment of any institution in the world. It is not, of course, expected to make firemen of the boys, but to give them coolness, courage and promptness in emergencies, and they also gain what so small a portion of the public have—a clear appreciation of the gravity of fire risks in cities and towns and intelligent ideas in regard to the prevention of fires.

The drill was arranged by the late Harry Ellis, superintendent of the school. It was introduced at first as a voluntary element, chiefly for the sake of the physical exercise and recreation it furnished, but the results were so satisfactory that it is now required from all the boys, excepting those who are physically unable to undertake it.

Every part of the drill is under the personal supervision of some instructor who has a thorough knowledge of all its details, and who is held responsible for the discipline of the boys and their officers and for the safety of all during the drill. As a preliminary, the pupil, on entering the class, is given a course of lectures explaining the use of a knowledge of fire prevention and fire fighting, the present methods employed and the improvements needed. Each boy is examined physically to find out his weaknesses, if he has any, so that they may be corrected. Simple marching movements are first introduced, and considerable time is devoted to the "setting up exercises" as practiced in the regular army. The boy is next given a belt and a long police club and instructed in the club drill. Later a sword made of tough wood is substituted for the club and instruction is given in single stick exercises similar to those of the navy. As a part of this preliminary drill, each boy is required to attend a course of lectures at the school given by skillful surgeons upon the various ways to render first aid to the injured. The pupil then begins work with the fire drill. The boys are formed into a battalion divided into hose companies, ladder companies, an engine company and an emergency corps. After this the pupil begins work, which includes holding and jumping into life nets from heights varying from eight to twenty-two feet; different forms of rope work, involving about all of the known methods of life saving, erecting and climbing ladders and the various ways of handling ladders; different forms of drill for fire hose, including coupling, carrying lines through buildings and up ladders, handling and use of nozzles, hose strips, spanners, etc.; shooting the life lines and other exercises tending to secure acquaintance with the different forms of fire or emergency apparatus.

To become a non-commissioned officer a private must have been on drill one year and then have passed a severe examination regarding his knowledge of military movements, Red Cross emergency work, handling of fire apparatus, etc. At the end of the second year, by passing another examination, he may become a sergeant.



FIRE DRILL—GETTING THE HOSE READY TO CARRY UP THE LADDER.

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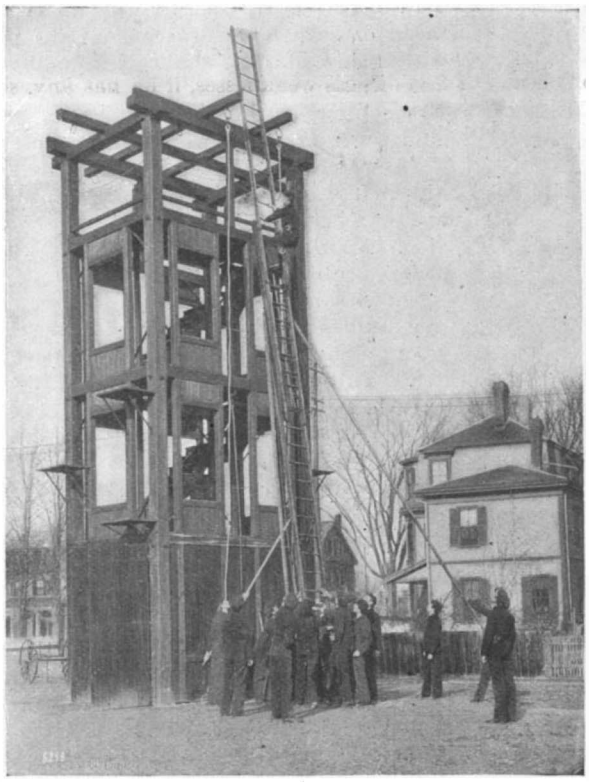
The lieutenants and captains are taken from the third and fourth year students only. The school is provided with the very best equipment. Alarms are given from fourteen boxes. The department is accustomed to second and third alarms and also to the "recall" or "all out" in use in large cities. Upon a first alarm one ladder truck and one hose company respond and the other apparatus follows when called by a second or third alarm. In the basement of one of the buildings is the fire drill room, which contains a ladder, truck, three hose carriages, an engine, an emergency wagon loaded with life lines and other articles needed for the drill.

FIRE DRILL—PRACTICE WITH THE LIFE NET.

The drill tower shown in our engraving is forty feet high and is arranged as a three story building, with stairways, window casings, etc. It is furnished with shelves on the outside from which jumps varying from eight to thirty feet may be made into the life net. Overhanging timbers are arranged at the top to support heavy iron rings to which ropes may be fastened for practice with the life belt. Near the tower are standards for horizontal life lines. One engraving shows the students practicing on these lines. This is most admirable exercise. Our other engravings show practice with the life net and the students preparing to draw a line of hose up to the roof of a building.

It is to be hoped that fire drills will be established in other schools, as it promotes alertness of body and mind, coolness and courage, and the benefits of discipline are increased. There is an element of dash about it which appeals to the ardor of youth and implants a sense of responsibility, while the constant chance of practically exploiting their acquisition gives it a realism which military tactics as an adjunct of general school training does not possess.



THE FIRE DRILL TOWER.

THE FEET OF CHINESE WOMEN.

The small foot of the Chinese woman, which the Celestials call by a name signifying "golden lily," has always excited the curiosity of Europeans.

I have no intention of passing in review all the motives that have been adduced in order to explain why the Chinese have for ages past mutilated the feet of women, since one is just as unlikely as the other. It is not until about the age of four or five years that they begin to produce this distortion. The result is gradually obtained by the use of tighter and tighter bandages that produce in the organ a double movement of antero-posterior flexion upon itself and of rotation of the last four toes and their metatarsal bone around the first metatarsal. The effect of this first movement is to break the foot into two parts—one of them anterior, comprising the toes and their metatarsal, and the other posterior and comprising the calcaneum. The scaphoid bone, which in this work plays the part of a hinge, is entirely put out of joint. It is always more or less displaced and raises the skin of the foot, which, at this level, sometimes ulcerates (Figs. 1 and 2).

The accompanying figures, reproduced from photographs, represent the foot of a young lady of twenty. Its length is 6½ inches, and its weight (with 2¼ inches of the ankle) 14 ounces. Viewed by its external face, it represents a rectangular triangle of which the hypotenuse, formed by the bone of the foot, is slightly convex at the level of the scaphoid bone. At the union of the third posterior and of the two third anteriors, its lower edge shows a cavity one inch in depth, resulting from the forced flexion of the foot upon itself. The lower face, of generally triangular form, shows us the arrangement of the deformed and compressed toes, which rest upon the ground through their dorsal surface. The nails are thin and atrophied, with the exception of that of the second toe, which looks like a claw. The diagram in Fig. 3 gives better than any description an idea of the deformation of a Chinese woman's foot.

After the foot has attained a sufficient degree of atrophy, and at the cost of considerable pain, the young Chinese woman has not yet finished suffering. She has to keep her feet constantly bandaged in order to be able to walk, and even then a long walk is impossible. The atrophy of the foot brings about an atrophy of the leg, which is reduced to the state of a skeleton, the muscles disappearing and hardly anything remaining but the skin and bone.

This atrophy of the leg contributes in a great measure toward increasing the trouble of walking and balancing. The Chinese woman can walk only with a shoe made to fit the form of her foot. This is provided with a flat heel which alone serves as a point of support for the entire body. The point of the foot does not touch the ground, and the women walk somewhat like club-footed persons. They are not very steady upon their feet, and when they become aged have to use a cane. They walk with their arms slightly extended and performing the office of a balance pole; and with the pelvis thrown back and the breast slightly forward, they seem to be endeavoring to preserve their center of gravity. When their heels are close together, the slightest push may upset them. A foot is so much the more appreciated in proportion as it is smaller. The one that I photographed belonged to a woman of the people and was relatively quite large. Among the rich Chinese ladies it does not exceed 5¼ inches, and the woman is prouder of her foot than of her face.

The Chinese woman is very modest when it is a question of her feet. I have several times attended mandarins' wives who were afflicted with foot troubles, and who consented only with great hesitation, and in blushing, to allow themselves to be examined; and even then they so arranged themselves as to expose only the ailing part.

All Chinese women do not have deformed feet. This mutilation is more frequent in the south than in the north, and in cities than in the rural districts. The Manchoo women are not authorized to bandage their feet; and on this subject there are very formal imperial orders.

Some of the missionary societies, and especially some of the female missionaries, have for some time past been waging a war against this so-called barbarous custom. They even addressed Tsoung li-James, beseeching that minister to transmit their request to the Emperor; but he answered them that the Son of Heaven gave his subjects the right to do as they pleased.

The Chinese regard a deformed foot as a thing of beauty. What would Queen Victoria say were she to receive a petition signed by numerous Celestials asking her to forbid the English damsels to wear corsets?—Dr. I. I. Matignon, in La Nature.

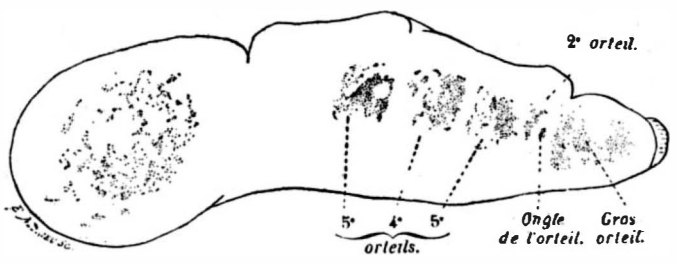


Fig. 3.—OS CALCIS AND DISTORTION OF THE TOES.

AT the Pennsylvania State College, Center County, Pa., a column has been erected which is composed of 281 samples of building stones procured from 139 localities in the State. The base block is of conglomerate 6 by 6 by 2·5 feet; the base of column is 5 feet square; the height of column is 32·7 feet; and the weight 53·4 tons. This polylith, constructed by the School of Mines, forms a comprehensive display of the natural resources of the State in structural materials, geologically arranged. It is a prospecting guide to the explorer for stone, and furnishes a comparative test of its durability by an equal exposure of all the quarry products to atmospheric influences.

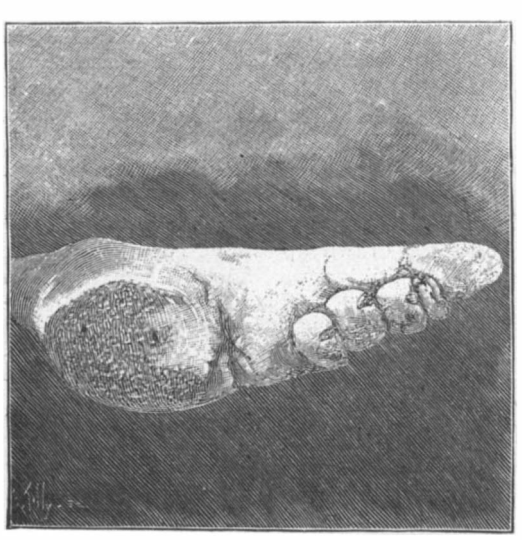


Fig. 1.—FOOT OF A CHINESE WOMAN—ARRANGEMENT OF THE TOES.

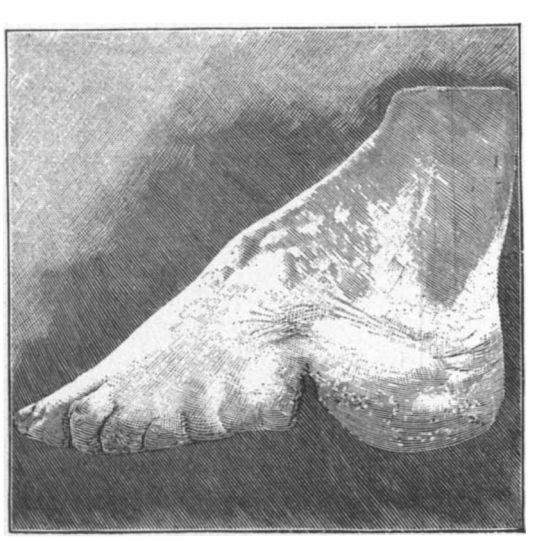


Fig. 2.—SIDE VIEW.

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TUSAYAN KATCINAS.

In the Fifteenth Annual Report of the Bureau of Ethnology to the Smithsonian Institution, 1893–1894, there is an interesting monograph by Mr. Jesse Walter Fewkes, entitled "The Group of Tusayan Ceremonials called Katcinas." By permission of the Director we are able to reproduce two of the illustrations from this interesting monograph. The following is only a brief summary of a part of the monograph. In their use of the word Katcina, the Hopi or Moki apply the term to supernatural beings impersonated by men wearing masks or statuettes in imitation of the same. The dances in which the former appear are likewise called by the same name, which with the orthography "Cachena" is used in descriptions of these dances in the valley of the upper Rio Grande. The present use of the term among the Tusayan Indians leads Mr. Fewkes to consider it as almost a synonym of a supernatural being of subordinate rank to the great deities. Ancestral worship plays a not inconspicuous part in the Hopi conception of a Katcina. Worship, as we understand it, is not a proper term to use in the description of the Indian's methods of approaching his supernatural beings. It involves much which is unknown to him and implies the existence of that which is foreign to his conception. Still, until some better nomenclature, more exactly defining his methods, is suggested, these terms, for their convenience, will still continue in common use. There exist in Hopi mythology many stories of the olden times which form an accompanying body of tradition explaining much of the symbolism and some of the ritual, but nowhere has Mr. Fewkes found a sequence of the ceremonials to closely correspond with the episodes of the myth. The characteristic symbolism is prescribed and strictly conforms to the legend. Anyone who has studied the ceremonial system of the Tusayan Indians will have noticed the predominance of great ceremonials in winter. From harvest time to planting there is a succession of celebrations of most complicated and varied nature, but from planting to harvesting all these rites are much curtailed. The simplest explanation of this condition would be, and probably is, necessity. There is not time enough to devote to great and elaborate ceremonials when the corn must be cared for. Hence, the spring and early summer observances are abbreviated. Although the Pueblo farmer may thoroughly believe in his ceremonial system as efficacious, his human nature is too practical to consume the precious planting time with elaborate ceremonials.

It has been proved by repeated observations of the same ceremonials that there is a great constancy in the way successive presentations of the ritual are carried out year after year. The inevitable modifications resulting from the death of old priests undoubtedly, in course of time, affect individual observances, but their ritual is never voluntarily changed. The Hopi do not get up the ceremony to please the white man. Each observance is traditional and prescribed for a certain time in the year. Mr. Fewkes then gives a tabular view of the sequence of Tusayan celebrations.

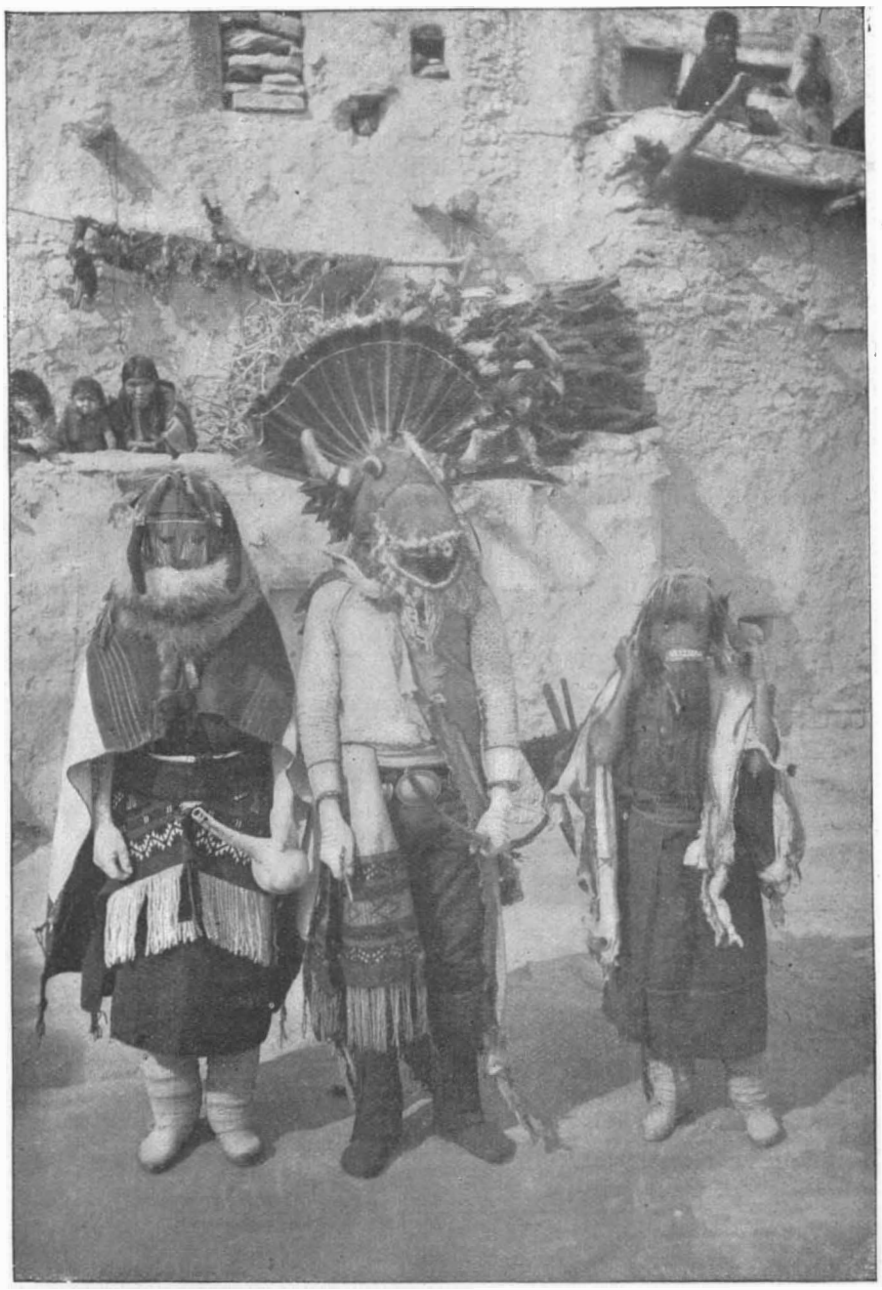
Before considering the various ceremonials in which the Katcinas appear, it may be well to say something of the nature of the supernatural beings which figure in them, as made known by the testimony of some of the best known men of the tribe. These deities are generally regarded as animistic and subordinate to the greater gods. They have been called intercessors between man and the high supernatural beings. There are misty legends that long ago the Katcinas, like men, came from the under world and brought with them various charms with which the Hopi are familiar. If there is any one feature which distinguishes a Katcina, it is the use, by some or all of the participants, of a mask or ceremonial helmet. The Katcinas are divided into two groups—the complete and the abbreviated; the former is constant year by year, the latter varying. Altars are present in the complete, absent in abbreviated presentations. A cloud charm altar, or invocation to the six world-quarter deities is sometimes made, public announcements are not prescribed, the clowns are generally present. Abbreviated Katcinas, consist mainly of public dances in which Katcinas, Katcinamanas and clowns take part. The prayer offerings are few in number and the ceremony ends in a feast, there generally being no altars.

Roughly speaking, we may say that the Katcina celebrations are characterized by the presence of individuals who do not appear in the unmasked or nine days' ceremonials. Mr. Fewkes classifies the Katcina celebration into two large groups which may be called the elaborate and the abbreviated. Under the head of elaborate Katcinas may be included Soyáluña, Katcina's return, Powámû, Pálülükoñti, Nimánkacína.

Space forbids our describing more than one of these ceremonies; so we will take the Soyáluña, which is distinctly a warrior's observance and has been called the Return Katcina. In one sense it may be so designated, but more strictly it is the return of the war god, regarded as a leader of the gods. The singing of the night songs of the warriors is one of the most effective archaic episodes of the ceremonial of the winter solstice. The following is a slight condensation of Mr. Fewkes' interesting observations on the events and celebrations of 1891.

On December 22 of that year most of the men of the village prepare cotton strings, to the end of which they tie feathers and piñon needles. These are given away during the day to different persons, some receiving from one to two dozen, which they tie in their hair. When a maker of these feathered strings presents one to a friend, he says: "To-morrow all the Katcinas to you grant your wishes;" holding his bundle vertically and moving it with a horizontal motion. At nightfall each man procures a willow wand from three to four feet long and loops upon it all the strings he has received. He then carries his stick to the Móñkiva and places it in the rafters, thus imparting to the ceiling the appearance of a bower of feathers and piñon needles.

All the Kivas were meeting places of the participants, but the Tátaukyamû met at the Móñkiva, where the principal festivities took place. Their chief wore a head dress decorated with symbols of rain clouds and carried a shield upon which was depicted the sun. The chief of a second society carried a shield upon which was drawn a star, and a third chief bore a shield with an antelope drawn upon it. The head dress of the chief Aáwympkiya was adorned with glittering triplex horns and on his shield was represented an unknown Katcina. The fifth society was Kwákwantû, or warrior whose chief carried in his hand an effigy of the great snake which was carved from the wooden stalk of the Agave, from which the society was named. He came from the Tcivato-Kiva and on his shield was depicted a Kwákwantû in full costume. The sixth society was the Tatcükti, or "knobbed heads;" their shield bearer wore a head dress like a coronet, while on his shield was drawn a black figure with lozenge-shaped eyes. The shield of the chief of the seventh society was adorned with the picture of the Sun Chief.



RELIGIOUS DANCE AMONG THE TUSAYAN INDIANS.

After the societies had entered the kiva an invocation to the cardinal points was chanted. At a signal the society raised itself into two irregular groups, one on the north, the other on the south side of the main floor. All then vehemently burst forth into a song, the shield bearer making eccentric dashes among his associates, first to one side and then to the other.

While the song lasted the shield bearer continued these rushes and the assembled groups crouched down and met his dashes by rising and driving him back. He madly oscillated from right to left and swung his shield in ryhthm while those near him beat their feet in time. The shield was dashed from face to face and the groups made many motions as if to seize it, but no one did more than touch it with outstretched hand. About eight P. M. a dozen men were collected in the Monkiva, among whom was Lésma, playing a flageolet. The hatchway was guarded by a tiler, and for a nátci there was placed there a wicker skull cap ornamented with a pair of imitation mountain sheep horns. Two hours later the room was densely packed with naked men, their bodies undecorated, wearing small eagle plumes attached to the crown of the head; two women were present. Anawíta, chief of the Kwákwantû, sat alone on the southern side of the main floor and twelve chiefs sat opposite him.

Ten novices from the other kivas entered gorgeously arrayed in white kilts, with brilliant crowns of feathers and white body decorations, bearing an imitation squash blossom, with spruce sprigs in their left hands and corn in their right hands. As the chiefs took their places Lésma sprinkled the floor of the room near the ladder with moist valley sand, about an inch deep. The novices stepped from the ladder upon this sand and passed up in front of the chiefs, then squatted before them, facing the south, their kilts having been lifted so they sat on the cold floor. Anawíta then crossed over to the south side of the room and seated himself at the east end of the line of chiefs.

At the west wall of the kiva a strange altar had been erected. Lésma had piled against the ledge of this part of the kiva a stack of corn, two or more ears of which had been contributed by the maternal head of each family in the pueblo. At either side and in front of the stack of corn shrubbery had been placed. In the space between the top of the corn pile and the roof wands were placed, and to these wands had been fastened many artificial flowers, four or five inches in diameter, set close together but in no regular line. Nearly in the center of this artificial shrubbery there was a large gourd shell with a convex side turned toward the audience and having an aperture about eight inches in diameter in its center. Through this opening had been thrust the head of an effigy of Pálülükoñûh, the plumed-headed snake, painted black, with a tongue-like appendage protruding from the mouth. When all the assembled priests were seated a moment of solemn stillness ensued, after which Súpela arose, cast a handful of meal toward the effigy of the snake, and said a short prayer in a reverent tone. Then the head of the snake, which was manipulated by an unseen person behind the altar, was observed to rise slowly to the center of the aperture, and a mellow sounding roar, like a blast through a conch, appeared to come from the mouth, while the whole head was made to quiver and wave. The sound was of short duration, repeated four times; then the head reposed on the lower rim of the ground shell. Presently was heard the sound as of a scapula drawn across a notched stick six times. All the old chiefs in succession cast meal to the effigy and prayed. In response to each the great snake emitted sounds identical to those mentioned above. The spectators then left the kiva and a frenzied dance of strange character occurred. The societies from other kivas came in, and the chief of each declaimed in a half chanting voice which arose to a shriek at the close of the stanza. First he drew back to the fireplace and then with a shuffling gait approached the symbolic opening in the floor called a sípapû.

Anawíta then shouted at the top of his voice and the shufflers sprang in the air and vaulted over the sípapû. Then everybody in the room shouted loudly, and a song and concert followed. A moment later the visiting societies dashed down the ladder, each bearing a splendid shield ornamented with the figure of the sun and a radiating rim of eagle feathers. Each society had its distinctive sun shield, which on entering was handed to the chief. As he received it he stamped on the sípapû and a fierce song was sung; meanwhile two members of the society stood apart from their fellows

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against the southern wall. facing each other, each holding a squash flower emblem in a bouquet of spruce twigs and an ear of corn in his left hand.

Suddenly the fifteen or twenty members of the society drew back from their chief, who then sprang upon the sípapû plank and, quickly turning, faced them as all burst forth in ecstatic shouting, with wild flinging of their arms, as they approached the shield bearers. They naturally formed two clusters, and as the shield bearer dashed his shield in their faces they surged back, to leap again toward him. This assault was maintained in time with the song. The two chieftains joined their men all in ecstatic frenzy and one of them, shaking his shield, sprang from right to left, drawing back his assistants in rhythm with the beating of the feet of all on the floor. After a few moments of most exhaustive movements, some of the weakest staggered up the ladder, and shortly after one of the chiefs fell fainting to the floor, overcome by exhaustion and the heat of the room. The men who belonged to the Móñkiva took no part in this exhaustive dance, but stood in readiness to carry those who fainted up the ladder to the outside.

It has been suggested that this assault of the man on the bearer of the sun shield dramatizes the attack of hostile powers on the sun and that the object is to offset malign influences or to draw back the sun from a disappearance suggested by its southern declination.

THE NATACKA CEREMONY AT WALPI.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

REFRIGERATOR CAR.—Charles S. Hardy, San Diego, Cal. In this car the ice receptacle, while designed to act with thorough efficiency for refrigerating purposes, is arranged to fold clear out of the way of an ordinary non refrigerated cargo. The ice box and draught flues are in the main arranged according to plans set forth in formerly patented inventions of the same inventor, the present patent providing for a swinging floor made in sections, and vertical doorlike sections corresponding to the floor sections and having cleats to support them when opened, with latch devices to hold the doorlike sections closed. When the apparatus is folded against the side of the car it takes up but little room and leaves the car interior practically unobstructed.

CAR COUPLING.—Elisha F. McMurtrey, Rison, Ark. This coupling is of simple construction, and is automatic in operation when coupling with another drawhead from which an ordinary link is projected, the uncoupling being effected from either the top or side of a car. An apron is fitted in the open lower side of the drawhead, and is pivoted in position to rock as the drawhead is met by an opposing drawhead, to guide the link in the proper direction, and release the coupling pin, which drops by gravity into engagement with the link.

Bicycles, Etc.

EXTENSION GEAR.—William E. Golding, Wakefield, N. Y. To enlarge a sprocket wheel on a bicycle, this invention provides a novel form of rim having sprockets on its periphery, while the inner portion of the rim has flanges on both sides to engage opposite faces of the sprocket wheel on the machine. The flanges on the inner face of the rim are adapted to engage the sides of the adjacent sprocket teeth, preventing lateral movement on the sprocket wheel in one direction, and on the opposite face of the rim are bosses adapted to pass between the teeth of the sprocket wheel, and be hammered down in the form of flanges, thus locking the rim on the sprocket wheel.

Mechanical.

BARK PEELING MACHINE.—John T. and George W. Jones, Western Port, Md. To peel or cut the bark from logs before cutting the latter into chips for making wood pulp, these inventors have devised a machine to do the work quickly and without wasteful cutting of the wood fibers. It comprises a set of log-turning and supporting devices and two series of yielding cutter heads arranged on independent axes alternately upon opposite sides of the log table, the cutter heads revolving in opposite directions to cause the pull of one set on the log to neutralize that of the other set. As the log is turned one series of cutter heads takes off a series of rings of bark and the other series strips the intervening portion, a single revolution of the log causing it to be entirely stripped of its bark.

SHEET PAPER DRIER.—Louis Dejonge, Jr., Stapleton, N. Y. This invention covers an improvement on formerly patented inventions of the same inventor, whereby the sheets will be conducted with greater advantage around with the cylinder of the coloring machine, the color being prevented from flowing under or gathering at the edges, simplified clamping devices being employed to deliver the sheets more accurately to the carriers by which the sheets are taken through the drying section of the machine. The drying section of the machine is so constructed that the sheets while wet will be supported throughout their travel in such a manner that they will not buckle, and the sheets will be delivered to a receiver in perfect condition, steam pipes being placed between the various tiers and also at the bottom of the drying frame to facilitate drying.

BAKING POWDER PACKING MACHINE.—James McNab, Catonsville, Md. As the mixed acid and alkali of baking powders quickly deteriorate when exposed to the air, while if arranged in layers the portions in contact form a neutral film between their opposing parts, preventing such deterioration, this invention provides for laying the alkali and acid powders in layers side by side or one upon the other, in such proportions as may be desired, in an accurate and expeditious manner. The machine comprises a belt carrier along which is reciprocated a carriage on which a divider is movable up and down, a pivoted rocking arm being geared with the divider and an operating mechanism connected with the arm. A delivery box is arranged at one end adjacent to the carrier, so that a box may be slipped over the end, a plunger forcing the box and the charge off the delivery plate and bringing a new charge in position to receive a box.

Agricultural.

COTTON CHOPPER.—Frank L. Richter, Moravia, Texas. A combined disk plow and cotton chopper is provided by this invention, one capable of attachment to any form of cultivator, the chopping attachment being so arranged that all surplus plants will be cleanly and quickly cleared from the ground and the standing plants be left at regular intervals. Upon the axle are secured cultivators, in advance of which are the chopping disks, placed at angles to one another, and revolved in close relation to each other at right angles to the cultivator disks, peripheral recesses in one chopping disk registering with corresponding recesses in the other disk. The disk plows, as the machine advances, cultivate the ground between the rows of standing plants, and the machine is of simple, strong and inexpensive construction.

Miscellaneous.

STREET SWEEPER.—Patrick F. Duross, Long Island City, N. Y. This is a device especially adapted for hand use, to take the place of hand brooms and sweepers. It comprises a box or receptacle for the sweepings supported upon wheels and having pivoted to it a hopper to receive the sweepings from a rotary broom, the sweepings being directed into the hopper by a chute which projects under the brush and guides the sweepings into the hopper. The receptacle is open at the upper corner adjacent to the hopper pivot, and the contents of the hopper are dumped into the receptacle by swinging the hopper up so as to fill this opening. At the lower corner of the receptacle is a door by which it may be emptied.

MUSICAL INSTRUMENT.—Gholson H. Graham, 2418 Magazine Street, New Orleans, La. To facilitate playing stringed instruments, as violins, cellos, etc., this inventor has devised an instrument in which a sounding board is held in a suitable casing, strings being stretched over the sounding board, and the performer will be able to properly play the instrument by manipulating the keys. The instrument has revoluble shafts adapted to be moved laterally, there being a hair-covered wheel on each shaft adapted to engage a corresponding string, and levers connected with the shafts adapted to be actuated by keys, the performer in playing the keys causing a sounding of the strings by the action of the revolving hairs.

SNAP HOOK.—Charles T. Redfield, Glen Haven, N. Y. This is a cheap and strong device in which the shank is provided with a seat with which the hook is adapted to interlock, the hook having a longitudinal and lateral tension, and being adapted to be sprung into and out of engagement with the shank seat, both of which operations may be easily effected in the dark with mittens or gloves on. The device is of especial utility in harness, or it may be constructed for use on vest chains, for snapping on the ring of a watch, for eyeglass holders, etc.

TOOL FOR MINERS' USE.—John D. Campbell, Leesburg, Idaho. This is a combination tool, embracing a candle holder, a powder knife, a fuse cutter, a fuse splitter, a cap crimper, and devices for securing the tool in a beam or suspending it from any convenient support. The tool is compact, and the candle will remain upright while every portion of the tool is being used, the cutters being readily removed for sharpening.

WINDOW CHAIR.—William Timmis, Pittsburg, Pa. This is a chair especially adapted for use as a temporary support in window cleaning, being foldable for placing it in or removing it from a window, and forming a firm and stable support when expanded and duly adjusted. The chair is composed of a retaining bar formed of two sections hinged together and a device for holding them in rigid alignment, transverse bottom bars being attached to two parallel bars, and being formed of hinged foldable sections having locking devices.

SKIRT RACK.—Cyrus H. Devlin and Norman H. Cowles, Bay City, Mich. In display stands or racks for use in stores, this inventor has devised a rack more especially designed for supporting a large number of skirts and trousers in such manner that customers may readily examine without danger of folding or creasing them. The base has a number of sockets in which are standards supporting parallel rods, a bridge piece connecting the rods, on the inner sides of which are fastening devices to support the garments, while allowing of their convenient removal as desired.

QUILTING FRAME.—Nina More, Cutting, N. Y. The parts of this frame are readily detachable, so that the whole thing may be packed away in small space when not in use, but forming a rigid structure when set up. Each side rail carries two extensible legs by which the frame is supported, and may be placed at the desired height, and the end and side rails are secured together by U-shaped clamps. On the upper face of each rail is a series of pairs of plates carrying clasps to hold the ends of the quilting material and facilitate stretching it as desired.

RIPPING AND STITCH PICKING TOOL.—James Darmody, New York City. For ripping stitched seams and cutting threads or bastings from the cloth, this tool is made with a body portion having a longitudinally curved cutting edge at one end and a transverse cutting edge at the same end, with a stitch picking hook at its opposite end, the cutting portion of the tool being covered with a shield when the hook portion is being used.

PNEUMATIC WATER RAISING DEVICE.—Edmund Pitcher, of Keene, and Edmund H. Sargent, of Sunapee, N. H. A windmill or other motor, according to this invention, is connected with an air compressor, and the latter is connected with a reservoir, from which a valved pipe leads to a submerged tank sliding vertically on guide rods, the opening of a valve forcing the water to the desired place of discharge, and the tank rising and falling according to the quantity of air and water in it. This pneumatic pump may be located at any desired distance and depth from the motor and air compressor, and a small pipe may be used for conveying the necessary amount of compressed air to the tank and forcing out the water to the required height.

SIGN.—William W. Reynolds, New York City. This sign consists of a hollow body having the face next to the observer of opaque material and dark color, through which the characters of the sign are cut, while a background within or back of the surface, and turned toward the observer, is of a light-reflecting color or material. The sign is to be illuminated at night by lamps placed within it, but not visible directly from the outside, the illumination being by reflected light from the background.

BOTTLE WASHER.—John Schutz, New York City. This is a machine designed to quickly clean and rinse a case full of bottles at one time. A vertically movable platform supports a box containing the bottles, and is provided with fixed nozzles through which water supply pipes extend, revoluble shafts extending through the pipes and carrying cleaning devices which extend beyond the top of the pipes and are adapted to be closed by the nozzles in the up and down movement of the platform. The cleaning devices are also adapted to pass into the bottles to clean them.

SHADE HANGER.—Ferdinand E. Stahlhut, Carpenter, Ill. According to this invention, the roller of the window shade may be moved to any point along the window frame, so that the shade may admit the light from the top or the bottom, or be adjusted as desired in other respects. These different adjustments are effected by drawing on a cord which extends down at the side of the window frame, where it is attached to a suitable cleat, the entire construction being simple and inexpensive.

IMPROVED BED.—David D. Toal and Richard Wilson, New York City. This invention provides a novel form of hammock, or suspended bed, sup-

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ported from standards at its four corners in such a way that the bed proper may be raised or lowered as desired, while over the bed, and also supported by the standards, is a frame carrying glass panes, preventing insects from falling on the bed, the form of the standards and frame being designed to thoroughly protect the bed against access of insects.

FOLDING BED. — Frank A. Cooper, Brooklyn, N. Y. In upright folding beds this invention affords a construction according to which the "action" is contained entirely in the body of the bed, leaving the casing unobstructed except by the brace rods strengthening the wings and preventing them from spreading. The bed has a weighted folding head rest, the head portion having a pendulum or swinging weight when needed. There are cam grooves in the side rails to receive rollers carried by the brace rod, whereby the bed body is pivoted or hung in the casing, and a removable end wall for each cam groove admits of the body being readily connected with or disconnected from the casing, the removable ends serving as stops limiting the outward movement of the bed when down.

BEDSTEAD FASTENING. — Edwin F. Tilley, New York City. This invention provides a simple form of fastening device for each corner of the mattress frame, to be fitted between and rigidly secured to the contiguous ends of the end and side rails, each device having a block slidably connecting with a corresponding body portion. By means of this device the sections of the bedstead may be easily and securely connected without inconvenience arising from the unevenness of the parts or from the unequal expansion or contraction of the metals. Either section of the fastening is adjustable on the other, not only enabling the fastening to be adjusted for non-uniformity of the post, but also to change the position of the side rail if desired.

LAMP BURNER. — George A. Bodee, New York City. To facilitate lighting the wick of a lamp without having to remove the chimney, this invention provides a burner in which the section of the burner on which the bottom of the chimney rests is formed with a horizontally swinging portion, which may be swung down when the match is to be applied to the wick, a spring holding the swinging section in closed position.

Designs.

PLUMBER'S TRAP. — Fredrick Kirchner, Brooklyn, N. Y. The body of this trap is tapering, being widest at the top and finished off at the bottom with the usual cap, the leading feature of the design consisting in the shape of the body.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

UNITED STATES GEOLOGICAL SURVEY REPORTS. Mineral Resources, Metallic Products and Coal. Charles D. Walcott, Director. David T. Day, Chief of Division. Washington: Government Printing Office.

In acknowledging receipt of vols. xxvi, xxvii, xxviii, the Director's Report, the volume on Economic Geology and Hydrography, and two volumes on Mineral Resources, of this splendid series of works published by the government, we cannot refrain from expressing, as we have heretofore done repeatedly, our high appreciation of the thorough and painstaking manner in which the work is carried on, and the skill and technical knowledge displayed, as well as our admiration of the luxurious volumes themselves, with their handsome print, wide margins and wealth of beautiful illustrations. The division of Mineral Resources, etc., under the charge of Mr. Day, now occupies two handsome quarto volumes, instead of the single octavo volume required annually previous to 1894, and it is not too much to say that from no other source can so much information be obtained on this great subject as from this series of volumes, commenced in 1883, the last two volumes covering the year 1895. The great scope of the work is realized when it is remembered that it includes metals, fuels, structural materials, abrasives, chemical materials, pigments, etc., while under "miscellaneous" are classified precious stones, mica, asphaltum, asbestos, mineral waters, etc, the principal treatment in each of the more important subjects being by recognized high authorities in each department. For instance, iron ores are written about by John Birkinbine; the iron and steel industries by James M. Swank; copper, lead and zinc by Charles Kirchhoff; petroleum, coke, natural gas, and manganese by Joseph D. Weeks; coal, abrasives, etc. by Edward W. Parker; stone by William C. Day; cement by Spencer B. Newberry; precious stones by George F. Kunz; and mineral waters by Albert C. Peale. The distribution, availability and product, in these several lines of the country's resources, together with the varying causes most generally affecting the demand, are set forth in these volumes from an independent standpoint, quite unaffected by the interests of dealers or promoters, which gives especial value to the figures and explanations.

CARBIDE OF CALCIUM AND ACETYLENE. Paris, France: J. B. Balliere et Fils.

This book is an enlargement of a series of popular lectures on acetylene by M. Jules Lefevre, of the University of Nantes. As a resumé of the experiments which have been tried with this gas and of its practical applications, it is quite complete. The opening chapters describe the various electrical furnaces used in the manufacture of calcium carbide, the different factories where it is made, etc.; while the latter part of the book is given up to the properties of acetylene in both the liquid and gaseous states, its employment for lighting and as a motive power, and its probable use in the future. The author does not think it will supplant ordinary lighting gas entirely, but that its general vogue will be between that of this gas and of the electric light. Owing to the ease and safety with which the gas may now be produced, as well as to the small expense, it will in time be used considerably for lighting small buildings where an isolated plant must be used.

Business and Personal.

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References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(7250) O. S. writes: I have a Ruhmkorff coil for one-half inch jump spark, made by the Varley Duplex Magnet Company. 1. What battery, of the lightest weight and least bulk will give the best spark this coil is good for? A. The kind of battery to be used with your coil depends on the work it is to do. If it is to be used for lighting gas, three to four Leclanche cells ought to work it. If you want it for more frequent use, the battery should be of the bichromate sort, and two to three cells are sufficient. 2. The condenser ought to be of what square feet surface? In measuring the surface of a condenser, will the ends be counted or only the tinfoil between the oiled paper? A. If your coil is a Ruhmkorff coil, you will find the condenser in the box under the coil. The tinfoil for a condenser is measured only between the paraffined paper. The ends which project have little effect. Condensers vary greatly in size. If you need to make a condenser for your coil, you will probably require sixty sheets of tinfoil 5×7 inches. 3. Would it be possible to get sparks at various points from one coil by having different return wires and breaking circuits in the return wire? A. Yes; in using a sparking coil for gas lighting this is the way it is done. The gas pipe answers for the return wire.

(7251) W. M. says: Will you kindly give me some information regarding a formula for a black dip for brass in which ammonia and copper are used? We have an acid dip which is used for this purpose, but believe the other would be more desirable. A. Dissolve in 4⅜ fluid ounces of ammonia ½ ounce of copper carbonate, stirring constantly while dissolving. Add ½ pint of water. The article should be suspended in this solution by brass or copper wires for a short time.

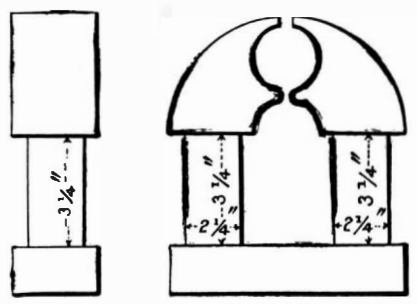
(7252) A. A. U. writes: I have the eight light dynamo and a motor of about the same size. Its field is wound with No. 18 wire, 20 pounds, and the armature with No. 16, two layers, 2 pounds. The dynamo and motor are about 100 feet apart on a No. 8 copper wire circuit. The dynamo has No. 12 on the field and is connected in series. How much resistance ought I to have to start my motor with? I intend to use the motor to run a lathe. A. A resistance of about 15 ohms will be required. It should be put in series with the field of the motor. Run the wire from the dynamo, through the resistance, to field, to armature, and thence back to dynamo.

(7253) H. R. K. writes: Permit me to ask for information regarding the famous eight light dynamo described in the SUPPLEMENT quite a long while ago. Made the machine exactly as described in your paper, but now want to use it as a motor on a 110 volt circuit. 1. What size wire shall I use on a new armature core of same size, and how shall I arrange the field circuits? A. For 110 volts wind your new armature with No. 24 A. W. G. wire, 25 turns in each of the 24 coils. The same field can be used with an external resistance of 750 ohms. 2. Could I not use it as it is by putting lamps in circuit with it? A. The machine can be run without rewinding by using an external resistance, either of lamps or wire, equal to or a little more than that of the machine itself. A resistance box is more convenient than a lamp resistance

(7254) P. C. S. writes: I am making an induction coil with a core 1⅛ in. in diameter and 15 in. long. The primary wire will carry about 8 to 10 amperes and the insulation is tested to 2,000 volts. It has about 100 turns, and is run from an alternating current dynamo. The secondary is about 12 lb. of No. 32, well insulated. About what kind of a current should I use in the primary (in volts and amperes) to get the maximum effect in secondary and longest spark? P. S.—How could I get the current from a 50 volt 1·5 ampere alternating current? If by a transformer, how would it be made? A. If a direct current from a battery is used, 4 to 6 cells of bichromate plunge battery, 1 to 2 quart cells, will answer for your coil. You need to be able to vary the current so as to learn, by experiment, how to get the best spark for any purpose, and the longest spark is not always the best. With a direct current your primary will take about 4-6 amperes and 10-55 volts. With an alternating current you will need a "choking" coil, rather than a transformer. This must be adjusted to the circuit in which it is to be used. The engineers of the system from which you draw your current could probably specify your choking coil for you. See SUPPLEMENT, No. 1124.

(7255) J. S., Montreal, writes: A question has arisen as to which of the following methods would be the best and cheapest for making a wall or division to prevent the transmission of heat or cold. To build the wall with a double air space, that is, with an outer and inner wall some distance apart and a thinner wall intermediate between them empty, but for the air. Or, to build a wall of the same material, leaving the same distance between the outer and inner walls, but leaving no middle wall, the whole interspace being filled with cork cuttings or shavings. A. The three-wall system, inclosing two air spaces, makes the best insulation, but not the cheapest. The three walls, in order to have the proper stability, must make a very thick and expensive exterior wall. The wide space and double wall will be very effective for insulation, if the filling can be properly packed so as to stay in place. The trouble with such filling is its disposition to settle and pack, leaving open spaces. The cost of either method of insulation is, we think, greater than the double wall with narrow clear air space, with a lining of asphalt paper on the inner surface, with 1¼ inch furring and lath and plaster. This constitutes a double air space with an airtight barrier.

(7256) O. T. writes: I have a casting for a dynamo, a sketch of which I inclose. Could you



tell me what sizes and how much wire I should use for the armature and fields for a 50 or 52 volt current (shunt winding) and how many amperes could I get from same; also speed required? Can you give any information in regard to winding of armature, as number of sections and turns on same? A. On the field wind 400 turns of No. 24 wire, B. & S., 200 turns on each side. Make the armature with 16 sections. Wind 20 turns in each section—No. 12 B. & S.

(7257) E. S. H., Illinois, writes: 1. What is your opinion or that of experts regarding the use of castor oil in a locomotive boiler? The water deposits a very salty substance wherever a leak appears and foams very badly; the use of the oil, however, effectually calms the foaming or priming, for it is probably more priming, as great quantities of water were carried over with the steam; so the engine could not be hurried at all. Is it likely to generate a dangerous gas? The water eats the iron very fast. Will the oil prevent that? It is used about a teaspoonful every day. A. Castor oil in boilers produces an effect similar to that of other vegetable oils, in gathering the lime and magnesia salts into cakes or nodules. It may answe the purpose for which it is used, if applied in very small quantities. We advise, if oil is used at all, that the cheaper mineral oil, as kerosene, is preferable. The oil in boilers does not generate a dangerous gas, unless, owing to low water, some part of the tubes or shell is subjected to a heat that will generate a gas by decomposing the oil. The oil will partially neutralize any acid quality in the water. The water of your district contains sulphate of lime and magnesia, and the separation of the sulphur in the form of sulphuric acid, and its action on the iron, is probably cause of the eating away of the iron. For this, we advise use of caustic or sal soda in small quantities, instead of the oil. 2. Again, what would be the highest speed practicable to run a simple plunger pump ¾ inches diameter, maximum stroke 2 inches, pumping a light engine oil at from zero to 500 or 800 pounds pressure? Also best style valve to use. A. For the short stroke pump at high pressure, 75 strokes per minute is allowable. Poppet valves are in general use and are the best for high pressures.

(7258) J. R. D. writes: 1. Give formula of solution used in making solder adhere to copper wire when making joints. A. To a sufficient quantity of hydrochloric (muriatic) acid, add zinc in small pieces, so long as it will dissolve. The resulting liquid is zinc chloride, and is used for soldering tin, copper, lead and brass. 2. Can an electric motor (costing about $1) be wired so as to run reversible? If so, how can this be done? A. The motor will turn in the opposite direction if the direction of the current in the armature circuit is reversed. In so simple a motor run by a battery any reversing switch will answer your purpose.

(7259) A. C. S. says: 1. Please give the full formula for the printing-out plantinotype process. The SUPPLEMENT, No. 1139, gives the following:

Chloroplatinite solution	116 min.
Iron	120 "
Gum arabic	116 "

but does not state the amount of the 10 per cent solution of sodio-chloride of platinum to add to the above. A. Add about 10 minims to begin with of last named solution, and increase amount until the requisite brilliancy is obtained. 2. Can the chloro-platinite of potash and the sodio chloride of platinum be obtained from the photo stock dealers? A. New York dealers can supply you.

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NOVEMBER 23, 1897,

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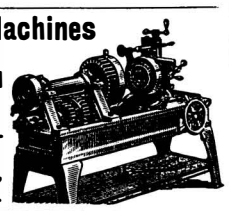

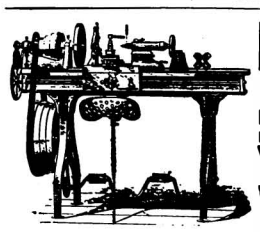

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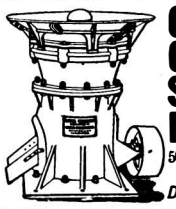

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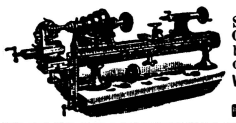

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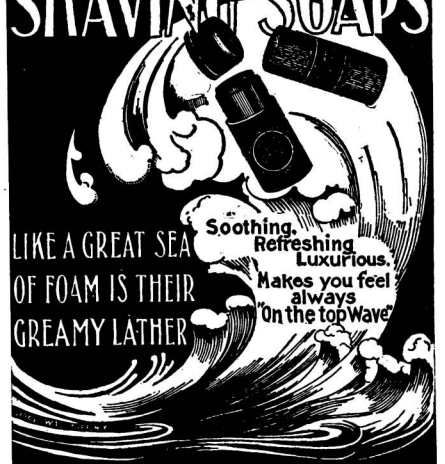

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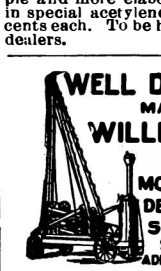

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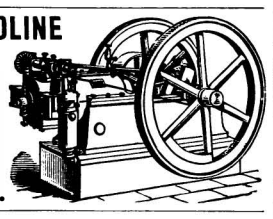

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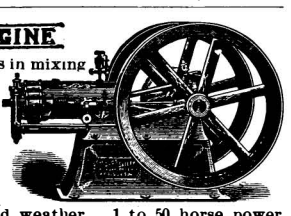

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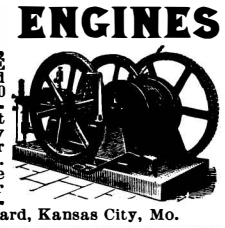

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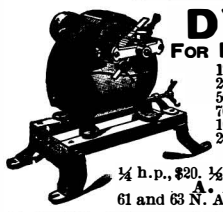

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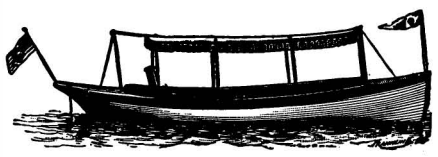

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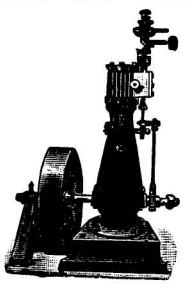

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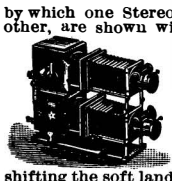

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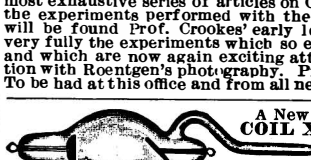

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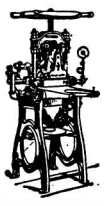

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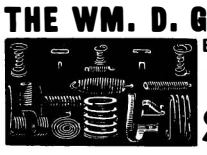

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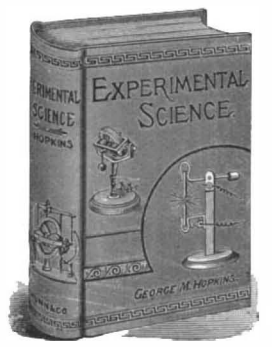

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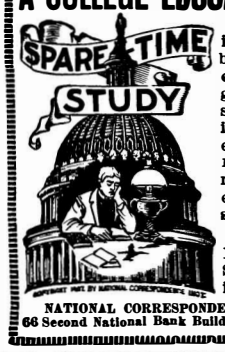

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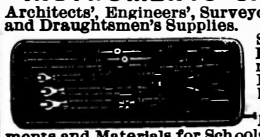

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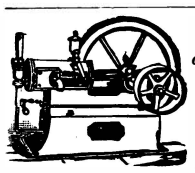

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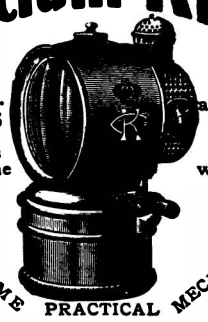

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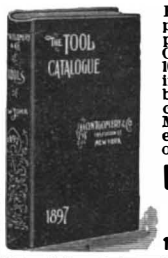

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